RACE2050 *- Responsible innovation Agenda for Competitive European transport industries up to 2050*

Deliverable 3.1
Impacts of European Policies on Global Competitiveness of the European Transport Industry

Dissemination level: PU

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1. Introduction (TØI)

This report synthesizes the outcomes of the research conducted within WP3 of RACE2050, a FP7 research project whose ultimate goal is to identify the key success factors – including the appropriate policy framework – for a sustainable growth of the European transport industry up to 2050. More specifically, the goals of WP3 are

1. Review and assess the academic, public and industry sponsored studies on on impacts of European transport-related policies on the global competitiveness of European transport industry.
2. Synthesize and document new knowledge on global position of European transport industry towards 2030, and
3. Provide inputs to long-term European transport, mobility management and industrial competitiveness policies in a medium (2030) and long-term (2050)

This deliverable (D3.1) aims at reaching the first goal.

The European Commission is quite aware that "*the regulatory environment in which EU industry and enterprises operate influences their competitiveness and their ability to grow and create jobs*"[1].

Therefore, the issue of how the EC policies affect the European transport industry's competitiveness will be analyzed from the different vantage points. One way of looking at competitiveness is from the perspective of a given industry sector using a series of well-known economic indicators[2].

However, this report summarizes results from studies which analyzed impacts that transport, environmental and social protection policies as well as safety, security and energy regulations imposed on industrial competitiveness in general, and global competitiveness of European transport industry in particular. Yet, in order to assess these impacts, we had first to clarify, what exactly is

[1] "Smart Regulation", European Commission, Enterprise and Industry, accessed January 22, 2013.
http://ec.europa.eu/enterprise/policies/smart-regulation/index_en.htm

[2] The indicators mentioned are presented in the Statistical Annex of the European Competitiveness Report from 2012.
1) Production index (an index of final production in volume terms), labor productivity (calculated by combining the indexes of production and number of persons employed or number of hours worked. This index measures final production per person or final production per hour worked.
2) Unit labor cost is calculated from production index and the index of wages and salaries and measures labor cost per unit of production[2].
3) Relative trade balance is calculated for sector "I" as (Xi-Mi)/(Xi + Mi) where Xi and Mi are EU-27 export and imports of products of sector "i" to and from the rest of the world
4) The Revealed Comparative Advantage (RCA) whose indicator for product "I" is defined as
   a. $\frac{x_{EU,i}}{\sum_i x_{EU,i}} / \frac{x_{W,i}}{\sum_i x_{W,i}}$

Where, X= value of exports; the reference group ('W') is the EU-27 plus 105 other countries; The source used is the UN VOMTRADE data base. In the calculation of RCA, XEU stands for the exports to the rests of the world (excluding the intra-EU trade) and XW measures exports to the rest of the world by the countries in the reference group.
Wages and Salaries" is defined (Eurostat) as "the total remuneration, in cash or in kind, payable to all persons counted on the payroll (including home workers) in return for work done during the accountin period, regardless of whether it was paid on the basis of working time, output or piecework and whether it is paid regularly. Wages and salaries do not include social contributions payable by the employer
(http://pp.eurostat.ec.europa.eu/portal/page/portal_rev2/introduction

understood by a policy? What factors shape and affect the "transport industry's global competitiveness"?

This deliverable starts delimiting the framework for a suitable definition of industrial competitiveness (chapter 2) and follows with an overview of the existing European policy instruments which includes a brief description of the evolution of European transport policy (chapter 3). Then, for each of the policy areas chosen

- Transport policy (task 3.1 / chapter 4)
- Environment policy (task 3.2 / chapter 5)
- Security policy (task 3.3 / chapter 6)
- Industrial Competitiveness Policy (task 3.4 / chapter 7)
- Social Security and Consumer Protection legislation (task 3.5 / chapter 8)
- Energy legislation (task 3.6 / chapter 9)

This deliverable provides a summary of the most relevant European transport policies – mainly from the last four years (2008-2012) –, followed by a description of the effects such policies had regarding their scope. Using multifocal approach, each policy chapter assesses the impacts that these policies might have had on the different sectors of European transport equipment and service provision industry as well as on their development and includes a tabular summary of the impacts of selected binding policy and the relevance of outcomes and objectives of specific EU co-funded research projects. Task' division among partners and the structure of each of the policy areas are described in the following figure.

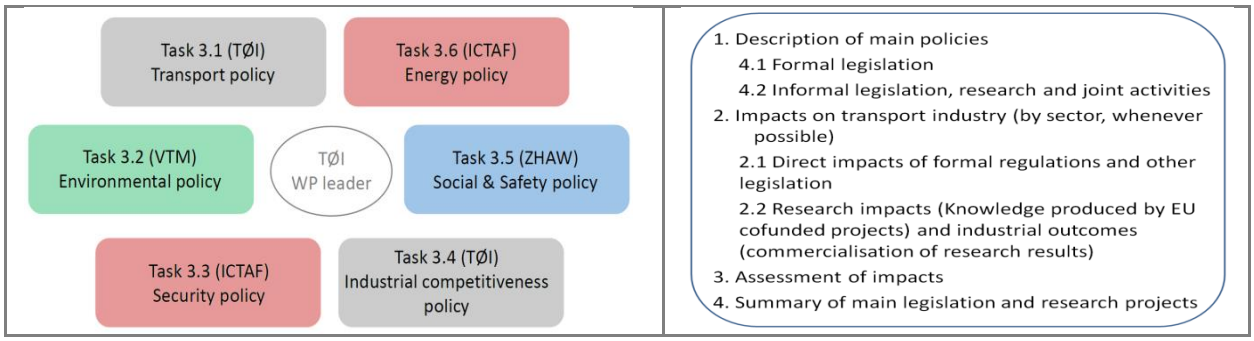


Figure 1: Tasks, partners and structure of each policy chapter of D3.1[3]

The analysis of the impacts of these policies focuses on whether the impacts comply with the policy's implicit and explicit objectives and

- If they do, how they might affect the transport industry's competitiveness both positively and negatively and what possibly negative impacts could evolve from complying with a particular objectives in the short and medium-terms
- If they don't, what are the hindrances which impeded and/or delayed the policy implementation, and how far this lack or delayed implementation has (positively or negatively) affected the focal industry.

[3] For some policy areas this deliverable could follow the general structure.

Finally, results are synthesized and some conclusions (chapter 10) are drawn for the subsequent research. The illustration below describes the analytical model for D3.1 impacts assessment.

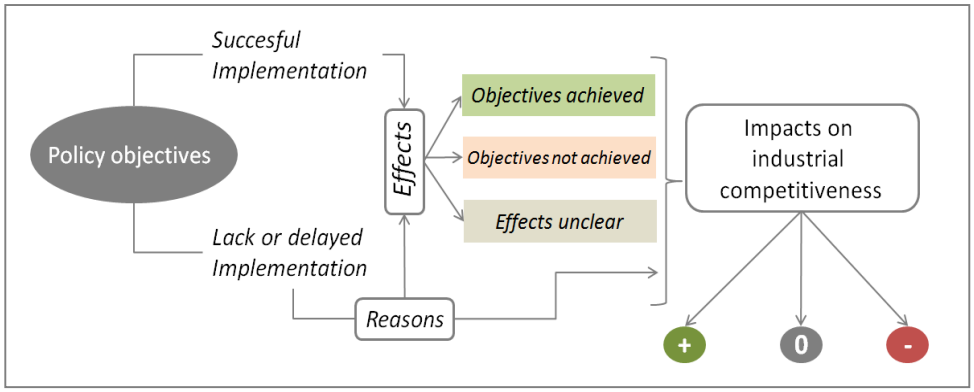


Figure 2: Analytical model for WP3

The review of relevant policy documents, reports, impact assessments studies, strategic research agendas, scientific articles and the relevant press releases were used to produce this deliverable. Due to scarcity of resources the research work was limited to the documents freely available on the web.

The research team is aware of the limitations of this research method. However, detecting an explicit evidence of impacts that the European policy has exerted on competitiveness of the European transport industry was not straightforward. Since not many policy evaluation studies could be found, we had to rely on several inferences and conjunctures. Hence, the results should be interpreted with great care. The scarcity of sources has also underlain our decision to concentrate on policies issued and enforced during the last 4-5 years. The consequent results might have been that the outcomes of policies reviewed either did not yet manage to fully emerge, were not possible to be clearly discerned or have not yet been thoroughly evaluated and assessed. Another limitation of the study emerges from its own structure. Since the document should cover multiple policy fields, it was decided to structure the deliverable according to the established work tasks. However, policy making is becoming more integrative and multidisciplinary. It is thus increasingly difficult to establish where a given policy area begins and where it ends. As a result there are policies which cannot be strictly classified into one policy area (transport, environmental, safety, and energy) because they target multidimensional goals. Just to name a few, SESAR is a transport and environmental policy aiming at dealing with operational air traffic management and environmental problems which already now create barriers for the aircraft industry. The border and customs control policy is a competence of the DG Home Affairs which is essential for maintaining of security. However, it is also highly relevant for transport of persons and goods as well as for industrial competitiveness of the transport equipment manufacturing industry. The Common Aviation Area is an ambitious policy field within the DG of Mobility and Transport which requires collaboration with the External Relations policy and which also affects competitiveness of European transport industry. The energy and environmental protection policies are also closely interrelated. Similarly, the research projects and the joint initiatives within these policy areas are also pertinent, since they often aim at production and operational efficiency gains while reducing the environmental impacts and/or improving safety conditions for either workers and/or consumers.

One just needs to read the White Paper on transport (EC 2011/C144) to realize how policy areas integrate and complement one another's goals. Being aware of this has helped the team to avoid duplication of work and address the issue studied in efficient way.

2. Competitiveness of the European Transportation Industry (TØI)

Two definitions of competitiveness have been taken into account when assessing the impacts of the selected policies on the European transport industry. Reinaud writes the following:

"Industrial competitiveness is a complex and multi-faceted concept. It depends on a number of factors including the primary and the secondary input costs, the availability of skilled labour, ability of companies to compete on quality, value-content as well as costs and generate innovations which could be successfully deployed in the market and commercially discharged. International industrial competitiveness is generally viewed as an industry's ability to export its goods, with industry being defined as a group of firms that produces similar goods and/or systems"[4].

According to the Global Competitiveness Report "competitiveness" relies on twelve pillars, institutions, infrastructure, macroeconomic environment, health, and primary, higher and vocational education and training, market efficiency, labour market efficiency, financial market development, technological readiness, market size, business sophistication and ability to innovate. Our task to assess how the European policies have influenced global competitiveness of European transportation industry will focus on impacts on they have invoked on business environments such as needs for environmental and social protection, energy effectiveness, and adherence to safety, security legislation and other legal requirements.

The last chapter of this deliverable reports on how the impacts revealed by the literature review might have affected these key features on which the competitiveness of European Transport Industry depends upon.

[4] Reinaud, J. 2004. Industrial Competitiveness under the European Union Emissions Trading Scheme. Paris: International Energy Agency

3. European Policy Tools and measures (TØI)

3.1 Policy instruments

3.1.1 Regulatory policies

European legislation consists of primary and secondary legal acts. While primary legislation provides basis for the EU functioning, it has relatively little effect in everyday life of European citizens and economic entities. It is the secondary legislation, with its binding and non-binding instruments, which impacts on Europeans day-to-day lives and European industry. The latter include regulations, directives, decisions and recommendations, although the last ones are not binding for all parties targeted. Regulations, directives, decisions are binding at different levels. While regulations and decisions are legally binding as regards their substance and the modes of implementation, directives are only binding in substance, meaning this that each member-state can decide how it should be implemented. Regulations and directives apply to all EU countries while decisions apply to specific countries and/or industries.

Adoption of binding legislation by the European Parliament and Council consists in a formal process known as co-decision. National parliaments can formally express their reservations if they feel that it would be better to deal with an issue at national level. Impact assessments, consultations among stakeholders, groups of experts' technical advices and public hearings take place before European Commission drafts a new law. These are made public in the form of Communications. The European Parliament and the Council may not agree with the Commission's proposals and propose amendments. If the Council and the Parliament still cannot agree upon amendments, a second reading takes place and eventually new amendments are proposed. At this stage the Parliament has the power to block the proposed legislation if it cannot agree with the Council. A conciliation committee tries to find a solution. Both the Council and the Parliament can block the legislative proposal at this final reading, and only if both institutions agree on amendments, the proposed legislation can be adopted, resulting in directives, regulations and decisions.

3.1.2 Non-regulatory policies

Due to the above described procedure, everyday secondary legislation decisions are demanding and time consuming. To avoid this, non-regulatory policies might be chosen instead. These policies, also defined as "soft law", are proposed because of their voluntary nature, and the lack of legal compliance obligations on the part of the MS or social partners. They are useful when MS are reluctant or cannot simply agree upon an issue[5], or when the EU has a limited competence. This flexibility increases participation of the civil society while it still enables the EU to influence the policy making process. Soft law or new governance tools are heterogeneous and include framework directives, co-regulations, partnership models, voluntary agreements and social dialogue. An

[5] The conflict between France and Germany as regards the EADS is an example of a dispute of national interests that affected the Airbus' competitiveness against Boeing due to struggle on the locations in which airplanes, helicopters and satellites should be built. Source: Eurotopics News. *Zu viel Staat schadet EADS* (on the article published on Handelsblatt – Deutschland) from November 21, 2012. www.eurotopics.net

example of an Open Method of Coordination (OMC) is the OMC/GIS platform which collects and stores technical and financial data on the TEN-T network and developes GIS-maps (for geographical modifications of the spot, thematic map-overlays, search engines, and print outs). Data input and validation are arranged in close collaboration with MS, allowing sharing a workspace through pre-defined validation workflows[6].

The European Transport Platforms (ETP) and the Joint Technology Initiatives (JTI) are also of this sort and together with the Framework Programmes have impacted on the development of European transport industry. ETPs were mainly created in order "*to define research priorities and action plans on a number of technological areas where achieving the EU- wide growth, competitiveness and sustainability requires major research and technological advances in the medium to long terms*"[7]. To provide guidance for European research funding and alignment of investment projects, the ETP congregate the sector stakeholders including industry, research, and public authorities, which develop the Strategic Research Agendas (SRA).

However, as the regular instruments of the Framework Programme for Research and Development proved to be insufficient, technologies became more complex and implementing those agendas required multidisciplinary efforts and greater financial resources, the Joint Technology Initiatives[8] (JTI) were launched. In this way ETPs define research needs while JTIs implement large-scale applied and industrial-based research, partly addressing these needs. Another difference is that while ETPs are not funded by the Framework Programme (FP), JTIs can be[9]. In order to carry out implementation (following the FP's principles of transparency, competition and excellence), each JTI defines a work programme. It also organizes calls for proposals and tenders, proposal evaluation, project selection, negotiations and signature of research grant agreements, projects follow-ups and reporting. The selected projects are jointly carried out using the EC and the MS research funds, as a part of the JU, and matching in-kind, i.e. non-monetary contributions and funds committed by industry, up to at least 50% of the total costs. Other possible sources are public funding, including, where appropriate, the Structural Funds and the Risk-Sharing Finance Facility. Funding members of JTIs can differ but normally include the European Commission and not-for-profit industry associations, formed by small and medium-sized enterprises (SMEs), universities and corporate members. In some JTIs Member States, Research Groupings and leading industries are also among the founding members. There are currently four JTIs which are relevant for the Transport Industry: Fuel Cells and Hydrogen (FCH), Aeronautics and Air Transport (Clean Sky), Nano-electronics Technology 2020 (ENIAC) and Embedded Computing Systems (ARTEMIS). Information regarding their organization, scope and results is summarized in the following chapters.

[6] European Commission, Mobility and Transport, Transport Infrastructures TEN-T, accessed on January 23, 2013. http://ec.europa.eu/transport/themes/infrastructure/tentec/

[7] European Commission, Community Research and Development Information Service, accessed January 23, 2013. http://cordis.europa.eu/technology-platforms/home_en.html

[8] The legal basis for the JTIs is Joint Undertakings, which are established under the Article 187 TFEU (ex Article 171 TEC). This article allows the European Union to set up JU for the "efficient execution of European Union research, technological development and demonstration programmes". Thus, a JU is the legal entity and a JTI is a special funding scheme for the implementation of the Seventh Framework Programme to ensure the JU's above mentioned goal.

[9] "JTI", European Commission , accessed February 11, 2013 http://ec.europa.eu/information_society/tl/research/priv_invest/jti/index_en.htm

As described above, there are various policy instruments co-existing. Regulatory policies require transposition into the member states' law codes, before they are scheduled for national enforcement and compliance (Bax 2012)[10]. We may thus deduce that the impacts of regulatory policies on the European transportation industry might be stronger than the non-regulatory ones. However, as mentioned, the process of adopting the legally binding acts is time-consuming and sometimes it is difficult to reach agreement. Non-regulatory policies, although lacking the binding power, offer greater flexibility which may foster voluntary commitments and deliver results quicker. Besides, non-regulatory policies extend the capacity of binding legislation to integrate diverse policy fields. Integrating and combining those otherwise fragmented measures within the JTI framework enables improving the research outcomes and attending to European industry' needs more effectively. They may facilitate the innovating of European economy and make it more capable of withstanding global competition. Because of that, this report shall cover impacts of both, binding legislation, i.e., regulations, directives and decisions, and soft policies promoting research and industrial development which together aim at increasing competitiveness of European transport industry.

3.2 Evolution of European Transport Policy

Transport is one of the European Union's (EU) foremost common policies11. It is governed by the Title VI (Articles 90 to 100) of the Treaty on the Functioning of the European Union. During the last 10 years, transport policy has evolved from opening the transport markets to cross-sector competition to increase of industry involvement while at the same time taking into account a series of important societal, environmental, global, technological, security and safety, sustainability and innovation issues. By liberalizing the transport markets, harmonizing the MS national laws, improving safety and security, adopting unitary social working conditions and passenger rights, the European Transport Policy contributed to creation of common transport area.

The most pressing issue that the European transport policy needs to resolve includes the conflict between free movement of persons and goods and reducing the negative impacts that increases in traffic congestion and GHG emissions imposed on traffic safety, human health and natural environment. Other issues include the European transport's energy dependency on oil resources[12], an unequal, and sometimes insufficient, infrastructure development across Europe, in addition to growing competition from developing countries. To cope with these challenges it is important to reduce energy consumption, congestion, environmental footprint, improve transport safety and efficiency, while at the same time do not diminish the transport's contribution to the EU economy[13]. The most recent emphasis on environmental friendly transport, includes proliferation of combined transport and introduction of external cost charges for health, safety and environmental damages.

[10] Charlotte Bax also classifies policy into regulation, economic instruments, and information instruments, also referred to as sticks, carrots, and sermons. Though her analysis refers to the United States, it may also apply to European policy. We could understand regulation as that of binding nature, economic instruments as the funding programmes and information instruments as Communications and Recommendations issued by the European public bodies.

[11] The Rome Treaty's entered into force in 1958 establishing the European Economic Community and creating the foundation for a common transport policy. Source: European Commission, Summaries of legislation http://europa.eu/legislation_summaries

[12] *"Transport has become more energy-efficient but still depends on oil for 96% of its energy needs"* Transport, European Union, accessed January 23, 2013. http://europa.eu/pol/trans/index_en.htm

[13] According to the *Roadmap to a Single European Transport Area* (EC 2011/C144) – COM 2011) 144 final - the European transport industry directly employs 10 million people and accounts for 5% of GDP.

But, has this worked so far? And how far has this taxation affected the extra-European competitiveness of transport industry? To assess this and how further policy objectives such as the promotion of rail transport, increasing the air traffic management efficiency or making the maritime services and shipbuilding a more attractive sector to work in (just to name a few) have affected the European transport industry it is necessary to look not only at transport policies *per se*, but also at environmental and social protection, safety and security regulations, the laws reducing energy consumption, and, the industrial competitiveness policies. Policies do not always explicitly and directly target the industry, but by addressing other needs and problems they may affect the industry's performance.

4. Transport policy (TØI)

4.1 Main transport related policies

4.1.1 Formal legislation

In the following a brief summary of the main binding transport policies issued during the last four years is presented for each transport mode.

Rail

The EU rail policies have contributed to separation of rail operations from infrastructure management, liberalization of market access for third parties [14], construction of several trans-European TENT-T lines, harmonization of national rail systems through modular integration of intercity, urban rail rolling stock and infrastructure, in addition to launching the European Rail Traffic Management System (ERTMS), and the European Train Control System (ETCS).
Over the last four years several decisions and one directive were issued as regards the technical specifications (TS) of interoperability, and ERTMS in order to

- Strengthen the certification and authorization process of lines and trains equipped with the European Train Control System (ETCS), thus enhancing the interoperability of trans-European rail systems and compliance with the essential requirements - Decision 2012/88/EU amended by Decision 2012/696/EU (EC 2012/696),
- Achieve interoperability within the EU rail system at the level of design, construction, service effectuation and upgrades, renewal of operations and maintenance, and acceleration of integration of the EU MS rail networks - Directive 2008/57/EC (EP & Council 2008/57)
- Integrate technical standards for conventional rail systems - Decision 2009/561/EC (EC 2009/561)
- Establish TS for infrastructure sub-systems of HSR system - Decision 2008/217/EC (EC 2008/217), safety in railway tunnels - Decision 2008/163/EC (EC 2008/163) and for persons with reduced mobility - Decision 2008/164/EC (EC 2008/164)
- Adopt TS to facilitate technical progress - Decision 2008/386/EC (EC 2008/386)

A common goal of these measures was to harmonize technical standards of conventional and high-speed rail and, thereby creating more effective and seamless transport, and increase the share of rail market vis-à-vis road transport.

Besides, Regulation (EU) No 913/2010 (EP & Council 2010/913) on European rail network for competitive freight sought to improve efficiency of rail freight transport through coordination between the different MS infrastructure managers to guarantee seamless international operations, increase the rail freight capacity and efficiency though common rules for selection, organization and

[14] Freight market access has been liberalised at national and international levels whereas passenger transport at international level only. European Commission's Mobility and Transport website, accessed January 25, 2013. http://ec.europa.eu/transport/modes

management of trans-European corridors and investments in infrastructure and technical equipment.

In January 2013 the Commission launched the fourth railway package, which still has to be approved by the European Parliament and the MS and whose main goal is to cut the administrative costs and facilitate entrance of new operators into rail passenger market. For this purpose the package proposes EU wide vehicle authorizations and safety certificates to be issued by the European Rail Agency instead of by each MS[15].

Road

The most recent binding legislation, Directive 2011/76/EU (EP & Council 2011/76), for road transportation seeks to reduce the inter-MS divergence as regards infrastructure charges on heavy vehicles in order to internalize the external costs of motorized traffic[16]. Its integrating character might, however, be not fully taken advantage of, since the directive, does not force the MS to levy charges but only suggests the rules how to do it, if they decide to do so. No European binding legislation exists for light vehicles either, but the EC monitors applications of the national vignette systems to avoid discrimination.

The Regulations (EC) 1072/2009 (EP & Council 2009/1072) and (EC)1073/2009 (EP & Council 2009/1073) issued over the last years defined the rules and operational conditions for access to international carriage of goods, passengers and services provided by hauliers non-resident in another EU country. Regulation (EC) 1072/2009 entered into force on May 2010 and entitled both the resident and non-resident hauliers, provided they are have necessary documentation, to perform up to three cabotage trips in seven days, commencing after a day when unloading of an international shipment was completed. However, when haulage takes place in a MS different to that in which the international shipment was delivered, the duration and number of operations were reduced to three days after entering the MS without cargo and to one trip only. However, implementation of Regulation (EC) 1073/2009 setting out rules for access to international passenger market served for coach and bus services is less complex; it simplifies several enforcement measures and lessens administrative burden. It enables any carrier who operates road passenger transport and who holds a Community license to operate cabotage operations of regular and occasional services if covered by a contract between the organizer and the carrier. The Regulation permits also offering of regular services as long as they are performed in the course of a regular international service with the exception of transport services meeting the needs of an urban centre or conurbation, or those between the latter and the surrounding areas.

Waterborne

The waterborne transportation includes both the inland waterways and sea voyage. The first is especially relevant for the European objectives regarding reductions of energy consumption, noise

[15] "European Railways at a Junction: The Commission adopts proposals for a fourth Railway Package", European Commission, accessed February 5, 2013. http://ec.europa.eu

[16] In general and not only for freight, the user- and polluter- pays principles aims at ensuring the better use of the infrastructure, reduce its negative impact on the environment and increase awareness of the impact of mobility choices among users.

and emissions not only because transport on inland waterways is cleaner and more resource-efficient,[17] but also, because it has capacity to bear a greater share of the intra-European transport and, thereby, ease the overland congestion. To take advantage of the European river transport potential, the Regulation (EU) No 164/2010 (EC 2010/164) and Directive 2009/46/EC (EC 2009/46), respectively address support for river information services (RIS) and the technical harmonization of vessels. Further key measures to increase usage of this transport mode are to ensure compatibility and interoperability with other modes technical standards and safety conditions.

For vessel transport at sea the Directive 2010/65/EU (EP & Council 2010/65) is most recent piece of binding legislation, whose objective is to simplify and harmonize administrative procedures by standardizing the electronic transmission of information and rationalizing reporting formalities. In addition, Regulation No 1255/2011 (EP & Council 2011/1255) to financially support further development of an Integrated Maritime Policy was adopted in 2011.

Air

Air liberalisation

The liberalisation of air transport began in the late 1980s. The Air Services Regulation – Reg. (EC) No 1008/2008 (EP & Council 2008/1008) adopted in 2008 defined modes of granting operating licenses, monitoring airlines and their access to the market, and measures combining highly competitive air transport market with high-quality service requirements and more transparent fares. This regulation has also simplified the rules imposed by the third and the last Air Liberalization Package which established legal baseline for operations of air transport companies in the EC.

Harmonization of procedures

Further, by incorporating technical requirements and administrative procedures into the EU legislation, as done by the Joint Aviation Authorities (JAA), Regulation (EC) No 859/2008 (EC 2008/859) seeks to improve the level of safety and functioning of the European aviation market.

The Single European Sky and Air Traffic Management

Over 2008-2012 several regulations were adopted to create a Single European Sky which dates back to 2004[18] and whose establishment was complemented by Regulation (EC) No 1070/2009 (EP & Council 2009/1070). The latter amended the previous SES legislation by adapting it to the pace of technical progress and improving the European aviation's safety, needs for environmental protection, and higher capacity and cost-efficiency. The most recent pieces of legislation include

- Regulation (EU) No 255/2010 (EC 2010/255) optimizing the available capacity at the European air traffic management network (EATMN) and enhancing air traffic flow management (ATFM) processes;

[17] For freight transport energy consumption per km/ton is approximately 17% of that of road transport and 50% of rail transport with modest noise and gaseous emissions according to European Commission, Mobility and Transport, accessed January 24, 2013 (http://ec.europa.eu/transport/modes/inland/index_en.htm)

[18] Regulation (EC) No 549/2004 of the European Parliament and of the Council of 10 March 2004 laid down the framework for the creation of the Single European Sky, although the initiative was initiated in 1999. For more information the following sites can be checked: http://ec.europa.eu/transport/modes/air/single_european_sky and http://europa.eu/legislation_summaries/transport/air_transport/index_en.htm

- Regulation (EU) No 73/2010 (EC 2010/73) enhancing the quality of aeronautical data and aeronautical information for the Single European Sky in terms of accuracy, resolution and integrity;
- Regulation (EC) No 262/2009 (EC 2009/262) coordinates allocation and the use of Mode S interrogator codes for the purposes of safety, more efficient civil and military operations and air traffic surveillance, and
- Regulation (EC) No 29/2009 (EC 2009/29) coordinates introduction of data link services based on air-ground point-to-point data communications to improve communications between the pilots and controllers, and adds additional air traffic control capacity.

Furthermore, the Single European Sky Air Traffic Management System Research Programme (SESAR) , a JU initiated by Regulation (EC) No 219/2007and amended by Regulation (EC) No 1361/2008 (Council 2008/1361) recognised as a Community body, to develop a new generation of European air traffic management system, by federating research & development efforts in the Community, while the SES Performance Scheme affected the Single European Sky through modernization of the European air traffic management (ATM) system. It improved the technical conditions and thereby also, the performance of air traffic. The following legislative acts are worth to mention within the SES Performance Scheme

- Regulation (EU) No 691/2010 (EC 2010/691) improving performance of air navigation services and network functions for general air traffic within the ICAO EUR and AFI regions by setting up a EU-wide binding targets for safety, environmental protection, airspace capacity and cost-efficiency. These goals are to be attained through adoption of European-Union wide performance targets and approval of consistent National or Functional Airspace Blocks (FAB) performance plans.
- The Safety Key Performance Indicators (KPIs)[19] were further developed by the Regulation (EU) No 1216/2011 (EC 2011/1216), which also amended the deadlines for assessment of performance targets, the Safety KPIs and the corrective measures for the national or Functional Airspace Block (FAB).
- Regulation (EU) No 1191/2010 (EC 2010/1191) ensuring transparency and consultation on how the costs of air navigation services are calculated and split between the various services to improve these services' cost-efficiency.

Besides, the below regulations enhanced the ATM performance and safety management

- Regulation (EU) No 176/2011 (EC 2011/176) defined the scope of information to be provided by the MS to the EC, the European Aviation Safety Agency (EASA), other Member States and interested parties before the establishment and modification of a functional airspace block took place,
- Regulation (EU) No 677/2011 (EC 2011/677) detailed rules for implementation of air traffic management (ATM) network functions to optimize the use of airspace in the SES

[19] These are a) the effectiveness of safety management as measured by a methodology based on the ATM Safety Framework Maturity Survey, b) the application of the severity classification (serious, major, significant incident, no safety effect and not determined) to the reporting of, as a minimum, three categories of occurrences which involve separation Minima Infringements, runway Incursions and ATM-specific occurrences at all Air Traffic Control Centres and at airports. MS may decide not to apply the method at airports with less than 50 000 commercial air transport movements per year; c) the reporting by the MS and their air navigation service providers through a questionnaire which measures the level of presence and corresponding level of absence of just culture.

area and ensure that airspace users can operate preferred trajectories maximizing their access to airspaces and air navigation services,

- Regulation (EC) No 482/2008 (EC 2008/482) laid down requirements for implementation of Safety Management Systems (SMS) software by air traffic service (ATS), air traffic flow management (ATFM) and air space management (ASM) providers for general air traffic, as well as suppliers of communication for reduction of risks associated with use of software in the European Air Traffic Management network systems, navigation and surveillance (CNS).

This provided legal framework for the SES' goals of improving safety performance by a factor of 10, decoupling of traffic growth from safety incidents, reducing delays, triple airspace capacity, halving the ATM costs, and reducing the environmental impact by 10%.

Airport policies: airport charges and slot allocation

At the airport level, Regulation COM (2011) 827 has been proposed by the Commission to introduce the market-based mechanisms to allow transparent and undistorted competition and improve the slot allocation and utilization (EC 2011/C827). Addressing the implications of the economic crisis, a Regulation (EC) No 545/2009 (EP & Council 2009/545) allowed the carriers to withhold slots. However, as this prevented the optimal use of scarce capacity at busy airports, several legislative changes have been introduced in the proposal which hiked the percentage of slot utilization demanded from airlines up to 85% from the current 80%, extended the minimum to 15 during the summer season and to 10 in winter. Further the proposal explicitly allowed airlines to buy and sell slots, performing second trading, to improve the slot mobility and airlines' adaptability to the changing scheduling needs. It has also introduced stricter criteria for independency of coordinators, and a charging system based on reservation fees and penalties to dissuade carriers from the late return of slots used. To avoid fragmentation and foster growth of sustainable competitors, it has also broadened the definition of new entrants.

Due to great variability of airport charges and the lack of transparency between the costs and the charges, the Directive 2009/12/EC (EP & Council 2009/12) was issued to ensure transparency in airport charges, avoid discrimination, facilitate information exchanges and solve conflicts between airlines and airports. To solve conflicts over charges a consultation on charges between the airports and airlines will become mandatory and an independent supervisory authority will be set up by the MS.

4.1.2 Informal Legislation, Research and Joint Activities

Increasing Research and Development Contributions to Competitiveness: The Strategic Transport Technology Plan (STTP)

Among all industries in Europe, the transport industry corporate R & D investments amounting to € 39 billion in 2008 were the highest. The European transport industry is also a global investment leader, accounting for 40% of all R&D industrial spending in this sector[20]. Contributions from MS

[20] EC. 2012. Communication from the Comission to the Council and the European Parliament on Research and innovation for Europe's future mobility Developing a European transport-technology strategy. COM(2012) 501. Brussels: European Commission

(€ 3.6 billion) and EU (€ 0.6 billion) are lower[21], but still important, especially for promoting the inter-modality and changes of systemic technologies because the private companies typically focus on one mode only. Yet, despite the high amount of R & D investments, the sector meets difficulties in market deployment of innovations that have proven to successful in demonstrations. To improve coordination of individual efforts including those already launched and/or which may still to come through JTIs and ETPs, the EC plans to launch a Strategic Technology Plan (STTP). A recent communication, COM (2012) 501 (EC 2012/C501) identified the following research and innovation areas for transport industry

- Clean, efficient, safe, quiet and smart road and rail vehicles, vessels and aircraft produced of new materials, and utilizing renewable energy sources and ICT breakthroughs to increase energy efficiency in new propulsion systems.
- Integrated cross modal information and management operations systems to provide seamless logistics and sustainable, integrated and innovative urban mobility through collective reservation and payment services, innovative tracking and tracing, and traffic management with re-designed delivery and distribution of goods.
- A long-lasting, climate-resilient and low-maintenance infrastructure capable to meet new requirements and offer alternative fuel distribution and ICT- based intermodal traffic management.

To facilitate the inter-modal integration, the EC recommends looking at research results and applications from other fields. To better integrate the transport users' demands with products and services supplied measures are proposed such as stimulation of the entrepreneurship, improved access to funding and end-user markets, attracting more workers to transport sector and the rethinking of education programs. Implementation of the proposed strategy will be supported by the European Transport Research and Innovation Monitoring System consisting[22] of an online platform with updated information on the European public and private R&D investments, roadmaps and progress reports.

TEN T-policies

From the early 1980s it was recognized that the development of trans-European transport network (TEN-T) and coordination of national infrastructure developments needed to go hand in hand with integration of European single market. The **COM (2007) 135 final "Trans-European networks: towards an integrated approach (TEN-T)"** was a relevant piece of legislation; its gist was that TEN-T will link-up the EU regions through joint transportation, energy and telecommunications networks and by so doing, facilitate economic growth and employment. By enabling goods and people to move faster between the Member States, the TEN will also optimise capacity utilization and soften environmental impacts making the EU better connected and more competitive. The Europe 2020 Strategy indicated that the state of the European transport infrastructure became central for the EU industry's competitiveness and employment enhancement. Facing the increasing transport demand, climate change and energy scarcity, the TEN-T is to create a set of efficient and sustainable single and multimodal networks which will fill the missing links, remove the existing

[21] Wiesenthal T., Leduc G., Cazzola P., Schade W., and Köhler J. 2011. Mapping innovation in the European transport sector. Luxembourg: European Union

[22] To be launched in 2013 according to European Commission's Mobility and Transport website, accessed on January 25, 2013 http://ec.europa.eu/transport/themes/research/sttp/trimis_en.htm)

barriers and extract the best value from investments. Policies supporting TEN-T have mostly been related to the funding. The TEN-T programme has been financed by the European Union through Cohesion Fund, the European Regional Development Fund and European Investment Bank's loans and credit guarantees. However, the following pieces of legislation have had more specific goals. Decision No. 661/2010/EU (EP & Council 2010/661) on the Union Guidelines for the Development of trans-European Transport Network identified a set of projects of common interests, which by integrating land, sea and air transport infrastructures will contribute to development of trans-European transport network by 2020. More recently new guidelines have been proposed, COM (2011) 650 (EC 2011/C650) to define a long-term strategy for the TEN-T policy up to 2030/2050. Another Regulation, COM (2011) 665 (EC 2011/C665), proposed the "Connecting Europe Facility" as a part of a larger European infrastructure package and the EU's budget proposal for the next multi-annual financial spending. The budget of €50 billion will be distributed between the following areas, transport will receive €31.7 billion, energy €9.1 billion and telecommunication and ICT €9.2 billion[23]. To attract private investment, the CEF will draw upon the Europe Project Bond Initiative, whose pilot was launched in 2012.

Furthermore, as Europe is not an isolated island within the increasingly globalised economy, extending the TEN-T beyond the EU frontiers became also key for the EC, for which five transnational axes have been identified. These include Motorways of the Sea, Northern Axis, Central Axis, South Eastern Axis and South Western Axis. Available information regarding cooperation with the neighbour countries, as stated in COM (2008) 125 (EC 2008/C125), showed that a set of adjustments in the already adopted guidelines (2007) were needed "*to better take account of recent progress, in particular in relation to Single European Sky and Galileo initiatives as well as the development of the future trans-European transport networks in the Western Balkan region and Turkey"*.

Beyond EU borders

Other informal actions have also been undertaken to integrate the neighbouring countries with the European strategies such as those addressing aviation challenges related to safety, environment and traffic management. The EC's communication on the Common Aviation Area (CCA) with the Neighbouring Countries, COM (2008) 596 (EC 2008/C596) provides an overview of progress made in this issue. Actions such as the "Euromed Aviation Project" include legislative approximation between the MEDA countries' laws on safety and security improvements and pursue increased ATM cooperation. Technical assistance is offered to countries in the Black Sea region and Central Asia, where information exchange between experts takes also place with similar objectives. Some actions in this area include the ISIS Programme and the EASA Cards project. The former represents the second-phase support for the implementation of SES in the South East Europe[24] whereas the later scopes the convergence of the EU safety legislation with that of the Western Balkans. Russia and Turkey are also neighbouring countries in which Europe has a special interest as regards improvement of framework conditions that favour the CCA. These interests do not pertain to the aviation sector only. Another communication, COM (2009) 301 (EC 2009/C301), describes a

[23] EC. 2011. Connecting Europe Facility: Commission adopts plan for €50 billion boost to European networks. Press release: Reference: IP/11/1200[24] For more information see the programme's website: http://www.isisprogramme.com/
[24] For more information see the programme's website: http://www.isisprogramme.com/

partnership strategy between Europe and Africa to be adopted for sharing experience and best practices to support the development of a more effective road, air, maritime and urban transport, and facilitate the air and maritime transport flows between both regions, which also involves the development of the rail sector as a connection link to landlocked countries and the establishment of infrastructure corridors.

Rail

Since a strong and competitive rail transport industry is a key for the European industrial development, most of the legislation regarding rail has been of binding character. But beyond the legislation previously reviewed, the long-term financing is also necessary to guarantee infrastructure development. So, the European Commission proposed measures in COM(2008) 54 on multi-annual contracts for rail infrastructure quality to be applied by the MS and infrastructure managers to create a financial and functional equilibrium between the transport service provision and the capacity of rail infrastructure (EC 2008/C54). The financial resources will now be put a step forward with the CEF. The fact that rail plays a central role within the EU TEN-T project is confirmed by the fact that it accounts for around 60% of its budget [25].

A major player within the informal policy framework is the *European Rail Research Advisory Council (ERRAC)*. Launched in 2001, it covers high speed, conventional, freight, urban and regional rail transport services. Since 2008, the platform is entirely funded by 45 representatives from equipment manufacturing industries, operators, infrastructure managers, the European Commission, Member States, academic institutions and users' groups. The ERRAC's most recent achievements were publication of Roadmap Project and the update of its *"Railroute 2050 Vision"* (ERRAC 2012). This vision identifies rail as the safest and cleanest transport mode and, thus, as an opportunity and solution for Europe's goal to develop a competitive and resource-efficient transport system. By increasing rail market share to 14% and 11% for freight and passenger, respectively in 2020 and to 22.2% and 15.3% in 2050 as compared to 11.5% and 7.6%, respectively, in 2000, the vision has concrete aims. To make them happen, seven priority areas need to be addressed: Intelligent Mobility, Energy and Environment, Personal Security, Safety and Homologation, Competitiveness and Enabling Technologies, Strategy and Economics and Infrastructure (ERRAC 2012). The Roadmap projects' quality improvement roadmaps are structured into key work packages[26] which are to facilitate transition from research needs to research projects, identify synergies between the different research activities and stimulate the private-public national and European research undertakings. The ERRAC considers that research activity is the most important measure to enhance the pace and the scope of innovation.

Road

While there is a binding legislation on road infrastructure charges for heavy HDV, no legislation

[25] "TEN-T EA Projects managed in Figures", European Commission's Mobility and Transport, accessed January 25, 2013. http://ec.europa.eu/transport/themes/infrastructure/ten-t-funding-and-financing/index_en.htm

[26] These are the greening of surface transport, encouraging modal shift (long distance) and decongesting transport corridors, ensuring sustainable urban transport, improving safety and security, strengthening competitiveness, past projects evaluation and evaluation database, communication and management according to ERRAC, accessed January 25, 2013. http://www.errac.org/

exists for light vehicles. This issue is under the MS's national policy purview. However, monitoring of the nationally managed road usage charges brought the EC to the conclusion that functioning of the national vignette systems is not always as non-discriminatory and proportional as required in the EU. This has resulted in Communication - COM(2012) 199 (EC 2012/C199) *on the application of user charges on passenger cars*, which provides guidance to the MS as regards increased infrastructure usage, reduction of the road's negative externalities and enhancement of users' awareness of impacts their mobility choices have generated , without however, compromising the free flow of traffic. The communication targets Austria, Bulgaria, Czech Republic, Hungary, Slovakia, Slovenia and Romania who already have a vignette system and also MS who may implement it in the future.

The *European Road Transport Research Advisory Council (ERTRAC)* launched in 2003 is also a key instrument to informally shape policy. Its members are private and public organizations involved in production of transport vehicles and subsystems, research and European and national governance bodies. It provides strategic plans for R & D, defines SRA and Implementation Roadmaps, stimulate public-private investments, coordinates the European, national, regional public and private R & D activities, clustering of the Europe R & D capabilities, and promotion of European research and technological development. All of these measures are to fortify and/or enhance the global competitive position of the European transport industry.

Waterborne

The European maritime industry is increasingly exposed to competitive pressures from non-European markets where operators have better access to cheap capital and labour, and where regulations are not so stringent when it comes to enforcement of international standards. Further factors which play against the European maritime industry are the scarcity of skilled workforce and protectionist trade measures by third countries, combined with the current economic downturn, high energy costs and overcapacity in certain lines of service. In order to deal with sector-specific as well as global challenges, the EC in a Communication, COM (2009) 8 (EC 2009/C8), bets on attracting skilled workforce and improving the shipping service quality through enhancements of the sector's environmental performance, safety, security and international cooperation, and access to research and innovation facilities, plus utilization of the European short sea shipping's competitive advantage. In order to reduce to attain these goals a dialogue with all relevant stakeholders needs to be established.

An ETP for the waterborne transport established in 2005 facilitates this dialogue by bringing together shipyards, equipment and systems manufacturers, ports, leisure industry, research institutions, classification societies and associations of the industry. Its publications from 2012 and 2011 include the "Vision 2025", the SRA and the corresponding roadmap. The SRA says that in order to maintain its competitive edge, the European maritime industry needs more innovation in design and production of vessels and equipment, and more cost-effective and efficient operations. Innovative vessels should take into account the entire life cycle, be ahead of new market needs and become environmentally highly optimized. At the same time, the research will focus on development of more modern equipment production methods, and systems for power generation and propulsion, automation of control, navigation and cargo handling operations. Next, to increase

the productivity, better integration of design and production within one process management system will be required. Modularization, application of new materials and production methods will also play a role. However, higher effectiveness requirements pertain also to operators, whose LCC planning, energy consumption, maintenance and platform management need to be re-considered to optimize the costs. In addition, technologies for new marine operations need to be explored. To facilitate growth and adapt to changing trade patterns, a third pillar of this strategy includes modernization of the entire maritime industry, ports authorities and infrastructure providers. The hope is that these changes will unlock new opportunities for the maritime and collaborating transport modes to become more intermodal.

The River Information Services (RIS) is an EC initiative consisting of publicly funded research and a binding legislation whose objective is to optimize the transport processes in inland navigation by imposing minimum cross-border compatibility and standardization of rule. The traffic management system is enabled by an in-advance and real-time exchange of information and a swift electronic data transfer connecting the water and the shore operations. Furthermore, the NAIADES action programme supported by the PLATINA project aims at creating favourable conditions for IWW development in Europe. For this purpose, the NAIADES focuses on improving market conditions, modernising fleet, development of human resources, raising public awareness and improving infrastructure. The PLATINA project, on the other hand, supports implementation of the former by providing technical, organisational and financial support and bringing together all relevant IWW actors.

Air

The European policy for air transport is mainly composed of regulations. The key measures to reach those policy objectives include funds for collaborative research in the framework of joint initiatives, public-private partnerships and the European Technology Platforms.

The **Single European Sky** (SES) aims to reform European airspace management, in order to overcome the existing fragmented system and increase the efficiency of the air traffic system. This initiative was launched in 2004, with the objective of accommodating future capacity requirements and safety needs at a European level, instead of a local level. **Single European Sky ATM Research (SESAR)**, legislated by the Regulation (EC) No 1361/2008, is the technological component of the SES that enables these improvements, funded as a Public Private Partnership between the European Commission, Eurocontrol and the Industry (Seventh EU Framework Programme IRELAND n.d.). SESAR programme is currently on its third of four phases, where the required new operational procedures, technological systems and components are produced. In the fourth and last phase of the program, the Deployment phase (2014-2020), the implementation and large scale production of the air traffic management (ATM) infrastructure will be carried out, resulting in a higher performance of European air transport activities (SESAR 2013, SESAR 2010). Additionally the ACARE plays an essential role as it develops and keeps up-to-date with the SRA in achieving the goals described in the "Vision 2020" (2011) and "Flightpath 2050" (2012). This European Technology Platform launched in 2001, involves today over 50 members including all MS, the EC, EASA, EUROCONTROL and representatives of manufacturing industries, airlines, airports, air navigation, research institutions, energy sectors and national regulators. One of the main objectives is to *win global leadership for European aeronautics through a competitive supply*

chain including SME (ACARE 2011). The support that the High Level Group on Aviation Research (an author of Flight path 2050) provides ensures coherence between the Clean Sky Joint Initiative (see next chapter) and the SESAR JU, and seeks interaction with other projects (e.g., AirTN) and ETPs (e.g., EPoSS, ManuFuture, EIRAC).

Another ETP in the aviation sector is the European Space Technology Platform (ESTP). The ESTP works on next generation technologies supported by its research agenda whose purpose is to add many new applications to the transport sector, thereby fortifying the Europe's transport industry's global competitive position.

4.2 Impacts on transportation industry by sector

This chapter reviews the impacts of legally transport binding legislation, the results and industrial outcomes (if any) of some European (mainly transport) research projects and joint initiatives co-funded by the European Union within the Framework Research Programmes (FP) as well as the effects that private-public initiatives and European Technology Platforms related to the transport sector may have had on the competitiveness of European transport industry. A review of the later is included because, even if ETPs haven't evolved into formal organizations and are mainly industry-driven, they are also supported by the EC, who evaluates and guides their work process (EC 2002/C714). Furthermore, the companies, especially the larger ones, generally agree that ETPs meet their technological needs and challenges (though they also consider that implementation of SRA is not significant enough and do not agree with the fact that the ETP's activities have really improved the framework conditions[27]). Thus, the contribution of such platforms to competitiveness of European transport industry should also be taken into account as they represent soft policy measures. Some of the selected projects do not directly fall within the transport sector, but because transport industry is related to multiple other industries, their results may also influence the transport competitiveness.

One can say that transport is the policy area where implementation of European legislation is one of the weakest in Europe, and where the lack of European policy transposition into the MS' laws is responsible for the compliance delay. Many MS still have not achieved the 1% of the implementation target[28]. This impedes not only the free travel, effective and efficient transport of goods within the Community, but also the industry's competition.

[27] For more information on the ETP evaluation carried out see (IDEA Consult 2008)

[28] According to the latest *Internal Market Scoreboard 26* (EC 2013 e) 20 from the 117 Single Market directives in the area of transport have not been transposed, there are 34 open infringements procedures for the inland transport sector and 60 for the air transport sector, being the duration of the later (34.3 months) far longer than the EU average (26.1).

4.2.1 Rail

Direct impacts

Freight and passenger rail liberalization

Liberalisation of rail market which opened public infrastructure to private operators has proven that rail market is economically attractive and that independent regulatory bodies did ensure a non-discriminatory access to network. However, an impact assessment study (Steer Davies Gleave 2012), maintains that in the opinions of some stakeholders, the regulatory bodies and the National Safety Authorities (NSAs) seem to exercise some discrimination against new entrants. But, once those practices are removed, market opening may stimulate new entrants to enhance market consolidation and offerings diversification also improving the service efficiency and quality.

Mergers and acquisitions undertaken to change the industry structure and increase productivity described by Renner and Gardner, 2010 may also increase railways competitiveness versus road transport. Research conducted in 2009 has shown that rail liberalisation did not achieve the expected modal shift (Savy 2009), but that market opening changed the structure of operators, as incumbents, under pressures from new entrants, rationalized their market service, restructured business models and, in some cases, also expanded beyond the national borders. The latter increased the consolidation level of international rail service industry (Steer Davies and Gleave 2009 a). This same study also reported that not all MS implemented rail liberalization legislation, but those who had experienced an upturn in freight growth as benchmarked by the Rail Liberalisation Index. According to this study (IBM 2011), the issue of how the separation of infrastructure and operations is organized does not seem to have big impacts on market opening. Indeed, Germany, Austria and Italy adopted a vertically integrated separation of infrastructure and operations, while the UK has separated and privatized both. The Netherlands and Sweden have also separated infrastructure from operations but maintained public network ownership. This seems to contradict the previous research (DG Energy and Transport 2006) which indicated that competitive tendering or franchising are more effective for liberalising the passenger rail while open access is more suitable for freight transport.

Liberalisation of passenger transport have increased competition and reduced transport costs of HSR, which DG Mobility expects will boost demand for long-distance travel to 416 billion pkm in 2020, an increase by 120 % as compared to 1999 (DG Mobility and Transport 2010). As a consequence this may also impact on European rail manufacturing industry, which covers 70% of the world rail market, employs more than 130,000 people and generates an annual turnover of around €35 billion (EC 2009 a).

Rail liberalisation appears to be quite limited impacts, especially as regards the international routes (EC 2011/S853). The level of competition remains also low as many national monopolies still control the national markets. However, rail liberalization might have generated negative consequences. The pressure on prices, combined with difficulty to receive public subsidies could reduce the rail service quality causing curtailment of passenger travel. More frequent train changes to reach certain destinations, longer delays, and longer transit time plus higher tickets' prices can

turn the passengers away from using trains. This in turn, may also decrease demand for rolling stock and other rail equipment from European rail manufacturing industry.

Interoperability and the European Rail Traffic Management System (ERTMS)

As ERTMS increases infrastructure capacity and decreases the costs of maintenance and training, the system offers infrastructure managers, operators and suppliers an opportunity to reduce pressures on prices. In addition, the publicly supported standardisation and research work on operations optimization have made the railway prices more competitive. Further improvements in system's efficiency and operational safety may enhance rail market attractiveness.

Yet, capitalising on all these benefits remains difficult because the system is not fully deployed. In fact, according to Steer Davies and Gleave (2009 c) the pace at which the deployment is happening is hampering the development of international rail. Nevertheless, measures introduced to improve interoperability of HSR and rail freight transport within Europe became implemented beyond Europe and the original fields of application. According to the ERTM (www.ertms.net), the currently installed or contracted ERTMS cover already 62,000 km of track lines in 38 countries, out of which 46% is abroad. Most of them are installed in Asia (China, Taiwan and South Korea), with interests also emerging in Gulf countries, Brazil, Australia and New Zealand, to name just few. Accordingly, the demand for the 7,500 ERTMS equipped vehicles with came from Taiwan, China and South Korea. This internationalization is expanding and diversifying the system's original application. Furthermore, the ERTMS is not only applied for HSR (China, Turkey, Saudi Arabia, USA), but also for freight (India, Indonesia, Gulf region), suburban transport (Rio de Janeiro, Mexico D.F., Auckland, Sydney), and the long and low-density lines (Russia and Australia). And as the different transport applications need also different components, ERTMS may need to be adapted to satellite navigation instead of balises, and other telecommunication means (TETRA, GPRS). This increase in global demand is unlocking new market possibilities got the European rail equipment suppliers and nullifies arguments that deployment of ERTMS across Europe, where the MS's operating conditions are very different, would not enhance competitive position of the European railway industry.

Infrastructure improvements (improved or replaced ballast, elastic rail clips and movable-point diamonds) and technology developments regarding rolling stock (aerodynamics, braking systems or bogies) enabled the deployment of HSR[29] beyond Europe with European manufacturers receiving orders from Asian markets (DG Mobility and Transport 2010). Furthermore, ERTMS along with investments on the main corridors in the triangle between Bosporus, CIS and Central Europe, and connections to the Mediterranean Sea ports [30] could unlock possibilities for intercontinental rail freight transport to Asia, thus attracting more passengers, and creating additional markets for European rolling stock.

[29] According to the *"EU transport in figures statistical pocketbook 2012"* (EC 2012 a), p. 52/78, HSR transport share (p/km) has increased from 15.9% (2000) to 25.7% (2009) and lines length in 2011 was 6830 km compared to 2708 km in 2000).

[30] EU supported investments on the main corridors in the triangle between Bosporus, CIS and Central Europe and the connection to the ports of the Mediterranean Sea, will increase the potential of the freight railway market to develop according to (SCI 2012)
http://www.sci.de/uploads/tx_edocuments/120828_Flyer__RailTransportMarketEurope2012.pdf

Pricing reforms

European policy makers believe that pricing is efficient tool for modifying the users' behavior. But for this to be true, the framework conditions need to be the appropriate. According to a study by Ricci and Enei (2008) the impact of pricing strategy will also be affected by the level of competition, which generally is higher in freight transport as compared to passenger. In Britain, differentiation of charges for rides on different types of rail vehicles increased investment spending of rail operators and, increased manufacturing orders for higher quality rolling stock. At the same time *the impact of rail infrastructure charges on operators is dampened by franchise agreements which simply pass increases in charges on to government* (Ricci and Enei 2008). Balancing charges between the IM and operators, the freight and the passenger markets and the low and the high traffic density lines is also necessary to avoid market distortions. The same study argues that high freight charges in Central and Eastern Europe may have affected the volumes of international freight and that pricing policies overcharging the high density passenger lines in order to keep up those which are low trafficked distorts the competition on the track. Furthermore, although the rail charge revenues mainly remain within the sector, they are still insufficient to cover the costs of infrastructure wear and tear, not to mention new investments. In fact, less than half of the total costs of both the passenger and freight rail transport in Europe are borne out directly by the users (DG Energy and Transport 2006); in 2009 the public subsidies to rail sector amounted to €46 billion[31]. Despite of this, demand for rail transport has not increased at European level. According to the same source, successful transposition of European legislation at national levels (Sweden and UK and Germany, Austria, Italy, Czech Republic and partly the Netherlands) has translated to some extent into improvements in services' quality and availability, which led to increased passenger satisfaction and growth (in some cases exceeding 50% over 10 years) and public savings of 20% - 30% as a result of public tendering. However a policy review by the TRKC reports that it is unclear how the different pricing strategies for rail service may influence the demand, *mainly due to severe data limitations, which are a consequence of the regulatory upheaval that the railway sector is currently running through* (TRKC 2010 a).

TEN-T

Since the TEN-T policy's main focus is on railways (18 of its 30 priority projects are dedicated to railways), it has been included under this sub-chapter. According to Steer Davies and Gleave study (2009 b) the TEN-T project has facilitated development of interoperable freight transport which also made the passenger rail more competitive vs. air and car transfer. The later enables logistics and freight forwarders to increase efficiency by combining the most suitable transport modes. But of course TEN-T not only applies to railways: 80% of its priority projects are related with railways and waterborne transport, 3 are mixed rail-road projects, 2 are inland waterway projects and one refers to Motorways of the Sea. TEN-T has been an important instrument to generally build missing links, remove bottlenecks and ensure a more sustainable mobility of people and goods between the Member States and also the neighbouring countries by promoting passenger modal shift from road to rail and from airplane to high speed rail can definitely generate the emissions reduction outcome. Besides, TEN-T has also contributed to innovations across all transport modes and more specifically, in the air

[31]"European Railways at a Junction: The Commission adopts proposals for a fourth Railway Package", European Commission, accessed February 5, 2013. http://ec.europa.eu

sector with the development of intelligent transport systems such as the GALILEO.

HSR and air transport

Clewlow (2011) maintains that on connections where a rail options have been established or expanded to, a substantial reduction in air traffic occurred because as rail journey time declines, the air traffic also declines too. The study reports that air domestic traffic from-to the airports of London, Paris, and Frankfurt has indeed declined, or grown at slower rates, and that the short haul reduction is due high quality of HSR. However, the study also reports that there has been a substantial increase in intra-EU air traffic even in trips where rail journeys would take less than 3 hours, and explains this through expansion of low-cost carriers.

Other documentation already mentioned (DG Mobility and Transport 2010) shows that on journeys which take under 3 hours, HSR are most competitive because access time to railway stations is much shorter than to airports and journey times are shorter than by car. That's why rail is preferred over air and road travel for journeys of between 400 and 800 km. However, we shall not forget that rail and air are not always competitors but sometimes may complement or even enhance each other. The document already mentioned reports that air traffic has increased after Frankfurt– Cologne HSL was opened (2002) and that *according to Deutsche Bahn, two thirds of train passengers are either leaving or have arrived by plane*.

Research impacts and industrial outcomes

Several EU-funded projects provided insights into how research and industry development may increase global competitiveness of European transport industry. The NEW OPERA project (Operating Project for a European Rail Freight Network) estimated how increase in productivity efficiency and interoperability may improve the rail freight competitiveness by recommending operational and technological optimisation for enhancement of service quality and operations in highly competitive business environment. The CREAM (Customer-driven rail-freight services on a European mega-corridor based on advanced business and operating models) and the RETRACK (Re-organisation of transport networks by advanced rail freight concepts) project both demonstrated how to establish new international rail freight services to be operated by both the incumbents and private operators. The CityMobil project targeting city mobility helped in identifying barriers that prevent large scale implementation of automated traffic management systems or URBAN TRACK with innovative solutions for light rail.

There are several other still ongoing projects, with relevance for competitiveness of the European transport industry in the medium to long-terms. For instance, the MARATHON project aims at demonstrating how to increase effectiveness of heavier, faster, and longer freight trains on selected routes, which may reduce the costs of freight carriage and speed up the industry's modernization.

The *GRACE project* (Generalisation of Research on Accounts and Cost Estimation) will generate better insights into marginal cost estimates and development of rail transport accounts. This knowledge may improve decision-making on the levels of future of infrastructure charges and how to improve its efficiency. Since infrastructure charges can account for up to 30 % of railway's operating costs, this knowledge is particularly relevant for rail freight competitiveness.

Other projects listed in the table at the end of this chapter are also relevant for increasing the rail competitiveness vs. road, and thereby unlock new opportunities in extra-EU markets.

4.2.2 Road

Road transportation is a major sector within the European industry and an important growth driver of the European economy. In 2012 it accounted for 11 % of EU GDP and contributed € 33 billion to the EU external trade. In particular, the automotive industry employed 1.9 million people directly, 14 million indirectly (EC 2009 a). However, due to economic crisis the number might have decreased to 12 million[32].

Direct impacts

Liberalization of the coach passenger market

The effects of the latest regulation regarding passenger cabotage services are not yet well assessed by empirical studies. A study carried out by Steer Davies and Gleave (2009 d) on impacts of legislation previous to the latest Regulation 1073/2009 shows that few occasional cabotage services were established and that the operation of international regular services were hindered by the MS' domestic restrictions and the temporary character of services offered.

The same study has also revealed the diverse level of liberalization across the EU, reflected by the regulatory and practical differences related to how the regular coach service functions in the different MS. Whereas there is no significant restrictions on occasional coach sector market, there are both direct and indirect barriers on regular coach service. The exception is Greece with regulatory restrictions on both markets. In Germany, and apparently also in France, Switzerland, and Austria no licenses were issued for coach services that run parallel to rail services to protect the rail's economic viability. Since on routes where both modes compete, the regular coach services are approximately 50% cheaper, these restrictions obstructed intermodal competition. Other indirect barriers to new entrances included the long concession periods to the existent operators, differences in availability of information, complexity in acquiring new concessions, and discrimination in favor of incumbents. The latter cases have been observed in Poland, Spain, Romania and Italy. This means that the lower costs, service innovation, and better fulfillment of passenger demand would not happen soon due to national restrains. This is especially true for occasional operators who in contrast to the regular service providers are hindered from benefitting from operations of long-distance routes in other countries, and access to reservation and ticketing systems for booking intermodal passengers. Additionally, vertical integration of terminals and operators in Poland, Spain, France and Austria hindered access to coach operators' terminals in these countries. This has forced new entrants to either use inconvenient stops at city outskirts or busy roads, or build their own facilities. Continuation of this practice may obstruct linking of many urban terminals, expansion of regular coach transport and development of intermodal urban systems.

New regulation on cabotage and liberalisation of road haulage transport

[32] European Union. Press release CARS2020 from November 8, 2012. http://europa.eu/rapid/press-release_SPEECH-12-792_en.htm

The Regulation 1072/2009 (EP & Council 2009/1072) has harmonized the documentation requirements and clarified the temporary nature of cabotage operations. However, to isolate and assess its impacts on the entire European transport industry is difficult due to several reasons. Some of these arise from both the pre-existing and the new road freight sector legislations. The former include the varying degree of opening of road transport markets to cabotage across Europe. This, in turn could also be related to the pre-accession treaties for the new MS, the existence of past and still binding agreements, i.e., for Benelux, and highly diverse national legislations. In addition, some differences also arise from inconsistent interpretation of the new regulation, despite the EC efforts to make it more unanimous. Also, confluence of other factors such as the different enforcement measures (e.g. sanctions) and fragmentation of control bodies, the lack of sufficient human and budgetary resources and national cabotage statistics, and eventually, the differences in vehicles insurance requirements (which hinder the other MS's hauliers to run coaches in Germany) make assessment the impacts of this policy quite demanding. Other issues, although not intrinsic to the road haulage legislation, are also highly related. These involve the enlargement of the EU and the *Posting of Workers Directive* (EC 1996), which affect the socio-economic context within which this legislation is implemented, and may, thus, also enhance the difficulty to dissect this regulation's impacts. Still another type of hindrances derive from the MS legal and economic idiosyncrasies exemplified by the national labour legislation, labour costs, the size of black-economies, the legality of flagging out the national operations, the geographical conditions of operations, and also, more widely, the economic downturn which caused a general decline in road transport activities, but also affected the individual MS very differently.

The Eurostat 2010 data have reported that increase in the cabotage market is *a healthy sign for growing competition*[33]. The tables below provide an overview of evolution in the European cabotage market.

Table 1: Changes in cabotage transport by EU-27 countries in which cabotage took place (1 000 tkm and %) (2002-2011)

2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11[34]
684 824	2 656 365	396 299	309 632	613 041	1 466 512	531 710	2 803 666	-253 469
6,3 %	23 %	2,8 %	2,1 %	4,1 %	9,4 %	3,1 %	16 %	-1,3 %

Source: own calculations based on Eurostat data [road_go_ca_c] (Eurostat 2013 a)

[33] Eurostat, *Competitiveness in EU road freight transport*, accessed May, 13th 2013. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Competitiveness_in_EU_road_freight_transport

[34] These figures are unclear since according to data from the same source for the same year cabotage recorded a slight increase of 0.3 %Eurostat, *Road freight transport statistics*, accessed May, 14th 2013. Differences could be due to the fact that in this source data from 2010 was used for UK instead of 2011, as appointed in the footnote. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Road_freight_transport_statistics.

Table 2 Cabotage transport market shares by EU-15 and EU-12 countries in which cabotage took place (2002-2011)

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
EU-15	99,1 %	98,6 %	98,8 %	98,6 %	98,6 %	98,6 %	98,6 %	98,2 %	97,6 %	98,2 %
EU-12	0,9 %	1,4 %	1,2 %	1,4 %	1,4 %	1,4 %	1,4 %	1,8 %	2,4 %	1,8 %

Source: own calculations based on Eurostat data [road_go_ca_c] (Eurostat 2013 a), Malta and Cyprus missing for EU-12

Table 3*:* Cabotage performed by hauliers from EU-15 and EU-12countries (million tkm) and market shares % (2006-2011)

	2006	2007	2008	2009	2010	2011
EU-15	13 206	13 624	14 517	12 446	13 176	12 306
EU-12	2 244	2 359	2 643	5 143	7 313	8 018
EU-15	85,5 %	85,2 %	84,6 %	70,8 %	64,3 %	59,7 %
EU-12	14,5 %	14,8 %	15,4 %	29,2 %	35,7 %	38,9 %

Source: own calculations based on Eurostat data, (Eurostat 2013 b). Malta and Cyprus are missing for EU-12

Poland, Netherlands and Germany are leading cabotage performers with 18%, 12% and 10% of respective market shares whose majority of cabotage operations take place in Germany (33%) and France (30%)[35]. Despite the growth in the share of the EU cabotage which accounted for only 1.2 % of the total ton/km produced in 2011, the cabotage still represents a very small fraction of the total road freight transportation[36]. Nevertheless, there are significant differences across the MS; from 0.1% - 0.2% in Greece and 3.3 - 4.6% in France, UK, Netherlands, Belgium, Bulgaria and Estland, and around 21% in Luxembourg[37]. The cabotage statistic from 2011 (the last year for which data is available) indicated that it increased mostly in countries which entered EU after 2004, Romania, Hungary, Czech Republic, Slovenia, Slovakia, Latvia and Lithuania, although not in Poland and Bulgaria. On the opposite site, high decreases in cabotage have been recorded in Italy, Sweden, Belgium and Austria during 2010-2011. Portugal and Denmark were the only pre-2004 MS recording two-digit growth in cabotage. The Eurostat statistics related to the changes in the average vehicle loads[38] showed that new MS (with the exception of Cyprus) have increased the average payload most between 2006 and 2011. Eurostat (2012) explains that this could have been facilitated by fleet upgrades undertaken as a result of integration with the EU. These technical upgrades may increase the European motor transport's competitiveness. However, the industry's competitiveness in the extra-EU countries might be hindered by legislative barriers.

[35] Eurostat. 2013. *Road freight transport statistics – cabotage"*, accessed May 14th, 2013. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Road_freight_transport_statistics_-_cabotage

[36] Eurostats. 2012. *Road freight transport statistics*, Table 1, accessed May, 14th 2013. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Road_freight_transport_statistics

[37] Eurostats. 2012. *Road freight transport statistics*, Table 1, accessed May, 14th 2013. http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Road_freight_transport_statistics[38] Eurostat. 2012. *Road freight transport by journey characteristics*, accessed May 14th, 2013 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Road_freight_transport_by_journey_characteristics

[38] Eurostat. 2012. *Road freight transport by journey characteristics*, accessed May 14th, 2013 http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Road_freight_transport_by_journey_characteristics

One of the key findings from the EU supported study on the "*Development and Implementation of the EU Road Cabotage* "(EU 2013) was that the growth in cabotage and the national road markets decoupled in 2009 when cabotage became open to the new EU members. During 2009-2013, the cabotage market continued to increase while the national transport markets first decreased and then stabilized. The fact that hauliers from the new MS benefitted greatly from the growth of cabotage is supported also by results from the *Road Freight Transport Vademecum 2010 Report* (EC 2011 b)[39]. The study (EC 2011 b) reported also that the empty runs, which accounted for 23.9% of all vehicle-km in the EU in 2010, were more frequent at own account transport providers (30.6%) than those who operate for hire and reward (21.4%), and in national (27.3%) than in international transport (13.6%). However, a study Aronietis and Vanelslande (2011) has indicated that limits set out by Regulation 1072/2009 for the duration of cabotage and the number of the operations allowed, hamper the cabotage's scope. Although they might reduce the empty runs, they may also reduce the cabotage market, thus reversing the degree of liberalisation instead of opening the market to competition. A higher exposure to competition has not only lowered the road haulage prices, but also decreased the operators' profit margins.

By combining these findings with evidence from a study of an Austrian market (Schramm 2012) showing that hauliers tend to split the freight forwarding operations into domestic and those that are outsourced to operators from the "Flags of convenience" countries (FOC), and when also considering the positive effects that creation of the "Crews of Convenience" countries (COC) on increasing the operators' mobility, then a conclusion could be afforded that cabotage in international transport produced new business models, which collectively have reduced the number of empty runs in the EU.

As mentioned, the entire set of possible impacts ascribed to the above regulation are difficult to pinpoint because a) this regulation applies to quite diverse EU markets, and b) a plethora of other internal and external factors also affects the cabotage development making the specific effects of regulation difficult to disentangle. For instance, the effect on some seasonally varying industries increased calls for relaxation of cabotage limits so that foreign lorry operators could work longer to avoid service shortages during the peak seasons[40]. However, according to the already mentioned study (EU 2013), some local industry groups asked for more temporary restriction on cabotage in order to protect their regional markets from foreign service-providers.
After having reviewed the documentation listed above, the following outcomes may be considered as impacts of Regulation (1072/2009)

- reduction of administrative burden due to availability of Community-wide license,
- some efficiency loss or at least some reduction due to limitations of the regulation's scope,

[39] According to this study "the lifting of special cabotage restrictions on 1 May 2009 … shows remarkable effects: cabotage activities of hauliers from these countries (those that joined the EU in 2004) almost tripled between 2008 and 2010".
[40] In UK both a consultation and an impact assessment have been undertaken. For more information see https://www.gov.uk/government/consultations/consultation-on-proposals-to-allow-ministers-to-relax-the-eu-cabotage-rules-for-car-transporters-during-the-peak-registration. Ireland got the approval of the EC to relax to a certain extent the rules. For more information see http://www.dttas.ie/upload/general/12896-CABOTAGE_NOTICE_24_12_10-0.PDF

- creation of some barriers to liberalisation and higher competition, but at the same time
- reduction of market access barriers that the "old" MS imposed against the new ones by more precisely defining the rules of access

Other impacts such as increase in flagging out practices within EU-12, exposure of market inefficiencies through higher pressures on prices, concerns about workforce shortages[41], and more frequent accidents may rather arise from opening of road transport freight markets to operators from the new MS as a consequence of EU enlargement and not due to legislation itself. It looks like that heightening of competition level has triggered several and variable impacts on the old MS. For instance, the German hauliers counteracted the low prices of foreign hauliers with increased efficiency and adoption of higher quality, reliability, and punctuality standards while French hauliers lost the market shares (EU 2013). Hence, we might conclude that a fully liberalised European cabotage road transport market is still far from being reality. The levels of liberalisation benefits such as reduction of empty runs and haulier revenues differ across the EU with the highest gains attained in Benelux, where the business environment was quite conducive to early implementation of cabotage agreements. The High Level Group on the Development of the EU Road Haulage Market has given some recommendations to tackle these problems[42].The European Association of forwarders, transport and logistics operators and suppliers of customs services has suggested that in order to better utilize the available capacity more monitoring of illegal practice is required (CEfor CLAT 2013).

Road charging schemes

According to Ricci and Enei (2008) the road pricing schemes do not change the user's choices of transport mode. However, the study recognizes a link between the pricing and the efficiency gains in freight transport and logistics in Switzerland, Austria and Germany, the fleet adjustment towards heavier vehicles in Switzerland and Germany, and diversion of traffic to the less suitable roads in Austria and Germany. It also argues that pricing policy is not the sole solution for road congestion, though its optimal use could reduce the needs for new roads. The study gives also an overview of tax revenue usages. The nationally collected fuel and vehicle tax revenues are normally earmarked to the governments' budgets and if not they are assign to finance the public transport (in Germany), transportation projects (in the UK) and motorways and railway tunnels (in Switzerland). Private road charges are earmarked to concessionaires who operate those roads while charges from public run toll roads and bridges are normally assigned to maintenance of infrastructure and sometimes, pass to engross the infrastructure funds.

On the other side, a research done by TRKC (2010) argues that case studies showed that *infrastructure usage charges led to changes in transport demand* in interurban road transport. It reports that the toll charging schemes have reduced the traffic levels by 14% to 23%, although the reductions were lower in cases where the main goal of the road charging system was to increase revenues instead of reducing traffic.

[41] In new MS due to a better attractiveness of international markets and in old MS due to an increased presence of foreign operators at national markets (EU 2013).

[42] For more information see the *Report of the High Level Group on the Development of the EU Road Haulage Market* issued in June 2012 (http://ec.europa.eu/transport/modes/road/doc/2012-06-high-level-group-report-final-report.pdf)

Two studies, the first by Booz et al. (2012 and the second by Christidis and Martijn Brons (2010), have revealed that the impacts of road infrastructure charges on freight and personal transport vehicles may vary considerably because the vignette prices are set up for quite different reasons. The existing vignettes that apply to private vehicles do generally charge for infrastructure usage, and not for the pollution harms. This may cause drivers of some private light vehicles to select other routes and/or even change the transport mode to avoid purchase of vignettes. This may generate revenue for operators serving the transport modes chosen (bus, rail), but it will hardly have an impact on the competitiveness of bus and/or rail industry at the global level. In addition, no relevant effect can be expected on global logistics because such vignettes only affect the small freight business. The resultant price discrimination may affect goods moved by smaller operators, especially in Central Europe and/or along the TEN-T corridors. Introducing a European discount for vehicles with low environmental impacts may increase promote sales and production of environmental friendly vehicles, also benefitting the vehicle manufacturers. However this impact may be negligible, because the benefits of such a discount are marginal as compared to the costs of a new vehicle.

The vignettes prices for freight operators are calculated according to duration of infrastructure usage and vehicle's emission class. However, the impact of vignettes on the service' final prices is minimal (0.5% on average). Yet, during the period 2008-2011, the vignette charge have increased the costs of the entire transport chain and reduced the volume of road freight transport by 0.7% (as compared to 2007). So one can deduce that road freight operators will minimize external costs imposed by vignette system. Similarly to personal transport, detour through alternative routes, better trip planning and vehicle utilization (minimizing the run of empty trips) will increase the operational efficiency in the short-term. On the other hand, investments in technology improvements, fleet renewal and organizational changes seem as sensible options for the longer terms. So, it seems that imposing of road charges on HDV has increased the operations efficiency by reducing the lead times, improving service reliability. This has increased the competitiveness of European road hauliers, freight forwarders and logistic companies. While these benefits may first be viable at European level, they may also develop innovative concepts for the extra-EU logistics markets. Also, lower delivery costs may reduce the costs of goods exported by the European companies. Besides, investments in fleet renewal may positively an effect the vehicle manufacturing industry and reduce fuel consumption.

Research impacts and industrial outcomes

The European Technology Platform ERTRAC is a key performer in designing roadmaps on how to implement specific research and innovation project. Its research priorities cover mainly environmental, energy and safety issues but also efficiency and integrated mobility systems. Aims like hybridisation and electrification of road transport, new fuel technologies, sustainable and efficient freight corridors and integrated mobility systems may increase long-term investments in innovation and technology upgrades, and thus enhance competitiveness of transport equipment manufacturers and service provision industry. The Platform is also involved in promulgation of the Green Car Initiative. However, documentation found on the platform activity outcomes refers to the

expected impacts only; it is thus difficult to assess *ex post* how this measure has really impacted on the industry's competitiveness.

The road transport industry may also benefit from projects funded under the 7th European Research Frameworks. ROADIDEA, for example, has developed innovative traffic prediction tools under different atmospheric conditions such as road slipperiness, fog, rain, bad weather and pilots for different distributions of road traffic. One of them, the Hamburg Port Pilot intends to test a model for predicting and distribution of road traffic volumes in line with ship arrivals and departures. The project's successful implementation might improve the traffic management and speed of container movement between the sea ports and hinterlands. This would increase the level of performance and competitiveness of European ports and also improve the operations safety. In addition to its cost reduction effects in Europe, deployment of these solutions by other large sea ports world-wide may increase demand for the European transport-specific ICT products.

The important of these research initiatives resides in the fact that they all are poised to deliver market products. Availability of public funds and initiatives such as ETPs offered to the automotive industry for technology improvements and cost reduction might benefit European consumers and thereby supporting purchases of European cars (Bullis 2012; Fairley 2012).

4.2.3 Waterborne

The European waterborne sector directly employs 3 million people and generates about € 200 billion in turnover and € 90 billion in added value (> 1 % of EU's GDP). The 14 thousand billion tonne/km moved by waterborne transport are higher than those by rail and road together and account for 90 % of EU external trade and more than 40 % of internal trade. Fifty percent of European production of ship systems and equipment are exported out of Europe (EC 2009 a).

But the inland waterway (IWW) and short sea shipping (SSS) sectors are facing problems despite of harmonization efforts and simplification of procedures pursued by the EC. Therefore, there is a need to establish whether the policies intended to improve the competitive standing of road and rail might not have jeopardised the competitive position of IWW and SSS. An article by (Douet e Cappuccilli 2011) reports that the "eco bonus" composed of 30% discount in sea-tariffs as compared to road haulage offered to shippers who moved goods by ferries instead of road, contributed to 4% increase in SSS shares in Italy and 6% in Spain. This suggests that the policies are effective. Whether these impacts will have relevance on global competitiveness of the European IWW and SS sectors is however quite uncertain, as these two transport industries tend to be served by the local manufacturers.

Direct impacts

Integrated Maritime Policy (IMP) and Strategic goals up to 2018

The progress report on EU IMP (EC 2012 a) highlights the impacts that the IMP together with other policy measures deployed in 2010 and 2011 exerted on attainment of the European 2020 strategic goals. The simplification and harmonization of procedures facilitated by the directive on

simplification of reporting formalities (2010) together with support for research activities and improved governance mechanisms (MARCOM+ forum, EMAR2RES) have collectively fostered collaboration between researchers, maritime industry and policy-maker.

Other measures such as the LeaderSHIP initiative and framework specifying conditions for the State Aid for Shipbuilding plus the schemes related to improvement of environmental protection, safety, employment and security are discussed in next chapters. Policy instruments such as the Third Maritime Safety Package improving the sea surveillance to eliminate the sub-standard shipping, enhancing the quality of European flags, efficiency and security of data exchange on maritime traffic. Several legislative measures that improved training for seafarers helped also to make the maritime careers more attractive and reduce the deficit of skilled workers, but are yet insufficient

Inland Waterways (IWW): harmonization of RIS, standard electronic transmission of information, rationalization of reporting activities and technical requirements of vessels

A review of CBA studies by a PLATINA project showed very high CBA ratios (PLATINA, 2010) and concluded that RIS is *a promising infrastructural project for inland navigation*. No study of effects of RIS harmonization on the IWW has been found. But, since the lack of harmonization standardization and specification of technical requirements are often mentioned as a main barrier to facilitate seamless transport and information flows, and *harmonization and coordination are a core requirement for the further implementation of RIS at the pan-European level* (EC 2005), we believe that the following policy acts are relevant for enhancing competitiveness of European IWW sector. Regulation (EU) No 164/2010 (EC 2010/164) outlined technical specifications of electronic ship reporting in inland navigation, and Directives 2010/65/EU and 2009/46/EC by harmonizing reporting activities and laying down technical requirements for inland waterway vessels, respectively, might have contributed to some RIS benefits. The above instruments specified conditions for establishment of electronic information platforms connecting all supply chain actors, facilitating reconstruction of accidents, tracking and tracing of loads and vessels, and streamlining the administrative procedures. The outcomes will emerges as

- Lower operations costs due to planning of voyages in accordance with the actual navigational conditions, increased utilization of vessels loading capacity, and standardizing of cruising speed to reduce fuel consumption
- Lower standby costs due to reduced delays and waiting times at terminals, borders and locks
- Reduced occurrence of accidents and lower insurance costs
- Lower logistics costs due to more realistic planning, elimination of breaks in information chain and better integration of supply chain members
- Higher efficiency of terminals due to provision of estimated times of arrival and information on stowage plans, vessel dimensions and streamlining of paperwork.

Main beneficiaries are the IWW transport industry, shippers and logistics operators and, in the case of intermodal supply chains, also other modes' carriers. The scope and the duration of benefits that a more efficient and effective IWW transport may generate on global competitiveness will depend whether the cargo carried is also a part of global value chains.

Strategies beyond EU borders

Several policy measures facilitating dialogues between the EU and the African Unions may simplify the customs and administrative requirements at African ports (EC 2009/C301). Also, the European freight and logistics operators may benefit from the European soft policies such as provision of aid to development of port infrastructure and hinterland connections in some African countries.

Pricing reforms

The evaluation by Ricci and Enei (2008) of impacts that pricing reforms in IWW transport might have generated on the sector's performance shows positive outcomes will not materialise as long as such reform does not cover all transport modes. Under the premise of fair pricing (i.e. covering only the marginal costs of operations) practiced by rail, road and inland waterways, the inland waterways would benefit from modal shift, though the benefits would not be significant enough to reduce the current congestion level. However, if pricing reforms were to be applied only to IWW, this would have negative impacts on ship building and related sectors. The report also indicates that the revenues from pricing schemes are internally earmarked.

Research impacts and industrial outcomes

Many maritime research projects seek to increase competitiveness of maritime industry by improving energy efficiency, reducing environmental impacts and the risks of accidents. These projects focus both on the design and construction phase of vessels. Optimizing the design phase through devising more reliable decision support systems and improving the computational fluid dynamics (CFD) technologies (VIRTUE, FANTASTIC) (EC 2011 c) not only reduces the design costs but also the costs and time invested in the construction process (since 80% of construction costs are defined in design phase). In the construction phase research on development of mobile laser hybrid welding equipment (DOCKLASER), which allows faster and more flexible welding, and usage of adhesives as an alternative to welding on lightweight aluminium superstructures (BONDSHIP) is of particular relevance. The later has demonstrated that due to reduction of production time, bonding is cost-effective despite of the high material costs[43]. In order to facilitate swapping of cargo-containing modules, the CREATE3S has explored the use of light-weight materials in modular design of ships. Efforts to reduce the life-cycle cost of vessels have also been undertaken by the BEEST project along with assessment tool that enables the shipyards to gauge the impacts that any innovation may have on the ship's life-cycle performance. The interSHIP project works on improving the integration of horizontal and vertical cooperation between the different sectors in shipbuilding industry while the MAARSTRUCT Network of Excellence explores how joint research may be optimized, which may positively affect the entire ship production chain from design to procurement.

The following is a review (EC 2011 a) of legislative, policy and coordination actions that NAIADES, PLATINA and other projects have undertaken, which may enhance the competitiveness of IWW. They are described according to the five strategic areas of NAIADES:

1. Work to improve market conditions:

[43] For more information see the project's website http://research.dnv.com/bondship/

- creation of an online portal with relevant information on IWT issues (new logistics solutions, technical innovations, infrastructure projects, political initiatives) to stimulate efficiency of transport solutions and enhance its visibility
- removal of 20 regulatory and administrative barriers
- creation of an online European Funding Database to encourage entrepreneurship
- development of innovative solutions to integrate the inland waterway into logistics and supply chains as elaborated by the RISING project

2. Steps that shall help to modernise the fleet:
   - establishment of pilot system for the European Hull Database to facilitate seamless international exchange of vessel data at European level,
   - establishment of an expert group to identify the new, the promising and the state-of-the-art technologies and innovations to be included into ship production technologies,
   - creation of an evolving online innovation database based on the wiki technology to enable the stakeholders to share information and practice
3. Measures that contribute to the development of human resources
   - technical support for the foundation of EDINNA (Education Inland Navigation) which shall harmonise the sector's education and training system and serve as a platform for exchange of expertise on development of new professional skills
   - harmonisation of professional competencies and job profiles for the operational and management level and development of joint recruitment strategy.
4. Measures to raise the industry image and awareness
   - set-up of an expert network for the exchange of good promotion practices.
   - analyse the current image of the inland waterway transport
   - publication of Good Practice Manuals containing some success stories
   - establishment of regular conferences arena
   - set-up promotion centres on Rivers Elbe, Po and Danube (in Hungary) to encourage customers to use inland waterways.
5. Measures to enhance the infrastructure
   - creation of an inventory of infrastructure development measures
   - publication of a manual on sustainable waterway planning

According to the EC 2111(j) document, the tool devised by the IMPROVE project to improve ship design are actually used by the participating shipyards. Also the DE-LIGHT project, which worked on light-weight materials developed a commercially applicable tool to assess the life-cycle costs of lightweight structures, improve the payload/ dead weight ratio and reduce fuel consumption and emissions.

4.2.4 Air

Yearly 1.4 billion passengers and 10 million planes crossed the European skies and landing and taking off from 440 European airports. These numbers are expected to increase at a rate of 5% each year reaching 16.9 billion passengers per year in 2030. To manage this magnitude of traffic an increase in air transport capacity and efficiency is needed. Legally binding and voluntary policy measures address these needs. Here we will look at how these measures have affected the air

transport sector which supports 5.1 million jobs and contributes €365 billion, or 2.4% to the EU GDP[44].

Direct impacts

Air liberalization

Since seventies, the international trade agreements reduced the tariff barriers and liberalised the international aviation market. Consequently, the demand for air travel has increased, from which aircraft manufacturers and service providers have benefited. The former increased the aircraft production and sales (especially for the mid and long-haul air trips), while the later expanded their service provision.

More recently the airline privatization enabled entries of new (mostly) low cost carriers (LCC) who financially and operationally challenged the state-owned European flag carriers. New operators pressed down the ticket prices and changed the consumers' perceptions of air service. Higher accessibility of air travel triggered substantial air traffic growth, which in turn brought about air transport congestion and severe environmental impacts. An old-fashioned slot allocation system and SESAR booking platform failed to enhance the air travel capacity or improve its operational efficiency. The entry of new airlines has not only increased the competition among airlines. Because the new, mostly small to medium-scale regional operators usually placed large orders for one single aircraft type, this purchase structure has also changed the competitive interfaces between the aircraft manufacturers. Addition of new routes and network expansions by the new airlines and the problems they faced with acquiring slots at main airports increased pressures to adapt infrastructure at regional airports[45]. An increase in LCC market share forecasted by some scenarios to grow from 42 % to almost half of the available air travel seat capacity by 2020 might also affect the tourism industry (Harvey and Turnbull 2012). Because LCC do not offer interlining connections to long haul flights, they disrupt the passenger air travel and, by so doing increase the demand for additional transfer. Also, since the LCC concentrate service provision at regional airports, this might also decrease infrastructure investments in capacity enlargement at the main hubs. Pressures from LCC on traditional airlines might also induce negative consequences on remuneration of employees of traditional carriers and the ground handling service providers (Harvey and Turnbull 2012).

LCC may also have some effects on rail passenger traffic. A study by Friederiszick et al. (2009) which analysed the panel data composed of monthly changes in air fares and the passenger volumes from January 2006 to October 2007 on 207 national and international routes starting or ending in Germany has shown that LCC were associated with seventeen per cent reduction in the number of second class rail passengers. Although this decline reflected price sensitivity of this customer segment, it was also recorded that the first class rail passengers defected from railways to national carriers which lowered their fares after the LCC enter a given market. These results indicate that

[44] European Commission's Mobility and Transport website, accessed February 15th, 2013. http://ec.europa.eu/transport/modes/air/index_en.htm

[45] "TEN-T focuses on financial support of selected, mostly under-developed regional airports, making better use of existing capacity, reducing the environmental impact, promoting better access and developing intermodal connections" from Žabokrtský, M. 2011. EU Air Transport Policy: Implications on Airlines and Airports available at the Center for European Studies website (http://ces.vse.cz/wp-content/zabokrtsky.pdf)

both rail passenger volumes and rail revenues can be reduced by competition from LCC.

Although competition between airports is not as fierce as between airlines, some airports took also part in privatization process. This is partly due to the legacy problems and partly due to the current policies. The designation of landing points determined by the air service agreements conferred on some European airports an important role of global transfer hubs. However, the nonexistence of slot trading system at these airports has tied up the airlines to the specific hubs, hindering expansion to other airports. The negative impacts that this arrangement exerted on airports consist in the lack of motivation to become more efficient, to enlarge capacity and to compete for more traffic. With the highest growth in air travel taking place on lanes to and from Asia, it is important that European air hubs expand the capacity to accommodate traffic growth and to remain globally competitive. This is however not happening. If European airports do not overcome the capacity constraints, growth in demand for air travel may cause them to lose the regional and/or global hub positions. Neither can airlines provide a competitive level of service if the airports do not facilitate their operations. Furthermore, airports are more than just the infrastructure providers. To increase the passenger revenues many airports established shopping facilities. Some others introduced multi-hubbing by taking advantage of capacity available at smaller regional airdromes, and adding the additional travel legs to initial routing to be in position to absorb more traffic.

The Single European Sky and Air Traffic Management

According to the EC review of the Single Market (EC 2013 a), the costs arising from the air network fragmentation reach each year €1 billion and extend an average aircraft to route by 49 km as compared to the situation where the planes could fly straight from origin to destination. Efforts to expand air transportation capacity such as new ATM systems may increase airspace capacity and safety, reduce routes length, user costs, delays and environmental impacts and increase traffic volumes. A more efficient and globally standardized ATM system may enable more frequent and shorter flights and more easily adopt the routing capacity to demand. And, given that some of the traffic management technology could be integrated into airplane fleets, several operations responsibilities could also be passed over from airports to airlines (U.S. Department of Commerce, International Trade Administration 2005).

According to an impact assessment carried out by the SESAR, the initiative will have a very positive impact in the economy, with a combined positive impact of € 419 bn over the period, on the employment creating around 328 000 additional jobs on direct, indirect and induced impacts, on mobility with an average of 10% reduction on flight times and 50% fewer cancellations and delays and on the environment with a positive net effect on total CO2 emissions from 2014 to 2030 despite the additional increase on air traffic, compared with a scenario in which no new ATM technologies are deployed (SESAR 2011). However, the gains in cost efficiency from the SES completion proposed by the EC to be 4.5 were lowered by MS to 3.5%, while attainment of SES targets delayed[46]. Even if reduction in the unit ATM/CNS financial provision costs by 6.8% as compared to 2009 and €800M savings from cost containment were reported in the latest ACE Benchmarking report (Eurocontrol 2012 a), still the costs of ATFM delays, will deteriorate the cost-effectiveness

[46] IATA. Press release "Factsheet Single European Sky (SES)" from December 2012. Accessed February 15, 2013. http://www.iata.org/pressroom

indicators[47]. Despite the cut in ATM/CNS provisions costs, the unit economic costs increased by 4.6% mainly due to 77.5% increase in the unit costs of ATFM delays, which again comprised almost twenty five percent of the total economic costs in 2010.

The Eurocontrol 2012 b report overviews costs that the ANS' inefficient performance, (which is a key to deployment of an efficient ATM system) induced on the air travel sector. Since these costs are borne by the airspace users in the form of additional time and fuel consumption, any delay in ATM compliance will have negative impacts on all airlines. The ANS related inefficiencies in the gate-to-gate phase have increased by 0.9% from 2010 onward, accounting for additional €3,730 million outlays and 8.1 Mt CO2 emissions. En-route and airport ATFM delays however, have decreased by 35% in 2012 as compared to 2010, reducing the total ANS-related airspace user costs by 4.3%. The lowering of economic costs combined with 3.1% traffic growth resulted in decreased unit costs in 2011. Still, en-route ATFM delays are still well over 1.6 minutes per flight against a target of 1 minute delay per flight set up by the Provisional Council. This indicates the scope of needs for the further delay reductions. The combination of these inefficiencies along with other factors such as rising tax regimes and high cost of complying with poorly designed regulations are magnifying the negative impact that the economic downturn exerted on the European carriers[48].

Slot allocation

Several problems have been identified with application and interpretation of regulation on slots allocation (EP & Council 2004/793) [49] . These include a sub-optimal use of constrained slot capacity at some airports and low slot mobility due to lack of incentives for incumbents to give up the under-used slots to new entrants, lack of transparency in slots re-allocation, and insufficient monitoring of regulation's implementation. Although the number of slots withdrawn varies between 0.4% at London Heathrow and 11.3% at Palma de Mallorca, the most congested airports show much lower proportions (Steer Davies and Gleave 2011). Since slot allocation does not use free market mechanisms which allow the highest payers to use slots within the most convenient time windows, the real value of unused slot capacity goes lost. Furthermore, since prices do not reflect the demand, investments in capacity expansion do not match the real needs. This may lead to over-investments at airports where capacity is sufficient and under-investments where it is scarce (OECD/ITF 2010). All these problems hinder the passenger volumes to grow and fares to decline. In addition, the lack of clarity in the existing regulations and its outdated status as compared to swift changes in air transport market have also contributed that the LCC developed new services at secondary airports.

Therefore, a series of changes in the existing legislation were proposed. Although, the overall impacts assessment of the proposed measures are not yet available, still some research exists which results are quite elucidating. By increasing competition between airlines so that the airport capacity could be more efficiently used, the new laws are expected to deliver 1.6% yearly growth in

[47] Composite flight-hour, a gate-to-gate measure which combines en-route flight hours controlled and IFR (Instrument Flight Rules) airport movements controlled.

[48] IATA. Press release. "Big Downside Risks on Weak Profitability-European Losses Deepen" from June 11, 2012. Accessed February 18, 2013. http://www.iata.org/pressroom

[49] European Parliament and the Council. 2004. Regulation (EC) No 793/2004 of the European Parliament and of the Council of 21 April 2004 on amending Council Regulation (EEC) No 95/93 on common rules for the allocation of slots at Community airports. Strasbourg: European Parliament and the Council.

passenger traffic and € 5.3 billion in net economic benefits against relatively low administrative costs estimated to be € 0.2 million for ensuring transparency in secondary slot trading (EC 2011/S1444). The beneficiaries of the secondary trading in the mid-term would mostly be the LCC. On the other hand, however, there are some concerns that the pressures on the airport-based carriers to increase slot utilization capacity up to 85% would propel these operators to fly half empty aircrafts instead of leasing the slots to other parties. Furthermore, a study by Steer Davies and Gleave (2011) has shown that the secondary trading and re-definition of new entrants would also benefit non-EU carriers such as Delta and US Airlways, Tam, Jet Airlines, Singapore Airlines and Emirate Airlines. Another study also confirms that introduction of more transparent information on slot availability would benefit not only new entrants but also non-EU airlines (EUACA and OCS). In addition, adoption of new rules at some airports such as Barajas-Madrid and Vienna would also create legal problems due to significant volume of non-EU traffic. A study by Mott and Macdonald (2012) suggests that new rules for slot trading would transfer majority of economic benefits to non-EU airlines and enhance usage of larger aircrafts at the expense of the smaller ones. This will negatively impact the aircraft manufacturing industry and additionally constrain the scare airport capacity at European hubs. Using the standard economic rates of passenger travel time values estimated at €23 for short-haul and €92 for long-haul routes to calculate the efficiency gains from re-use of slot capacity, the study asserts that the new slot allocation measures would reduce the flight numbers between the European major hubs and the peripheral regions. Hence, the increased efficiency would bring no benefits but rather losses because higher numbers of business flights often carry fewer passengers while much smaller aircrafts are used on regional routes. In particular, charging the slot reservation fees to increase the usage of historic slots up to 85%, and reversal of grandfather rights from non-scheduled operations may also adversely impact the regional carriers. Furthermore, the complexity and the costs of the proposed new reporting and approval procedures would affect negatively all European carriers. The EBBA/ERA evaluation (Mott Macdonald 2012) presents evidence that several negative impacts have already emerged in the form of increase in traffic operated by large aircrafts, and reduction in traffic performed by smaller aircrafts, and reduced number of connection between the European western regions and non-coordinated airports. The adoption of new rules might thus cause additional job losses and reduce regional access to long-haul flights. Although these assessments are only provisionary, still, one cannot dismiss a possibility that they might be right. In the latter case, adoption of new legislation on re-use of airport slot capacity may become counter-productive for the European air transport's global competiveness.

Aviation taxes

Majority of European airports charges the weight-based usage fees. A study by OECD/ITF (2010) recognised several problems with these charges both at airports with capacity surplus and capacity deficiencies, though the impacts on the latter is much greater . The weight-based system does not correlate with the scope of airport wear and tear costs and the distances flown; it also penalizes usage of larger aircrafts and prevents slots from being used more efficiently by airlines operating large machines. This system can also have repercussions for the airlines aircraft choices and thus for the aircraft manufacturing industry. The same study has also detected that the traditionally used rates of return or cost-based reduction in airport charges prevent airports from investing in capacity expansion and increasing operational efficiency and competitiveness. Several mechanisms to

improve this condition are mentioned, some of which, such as the revenue-shared arrangements, have already been used in Germany.

Airport charges are paid by airlines which then pass them on to consumers. Since this affects the price, the airport selection might depend on the level of charges to keep the airlines competitive. However, it doesn't seem to be the case at least at major airports. Finding from Ricci and Enei (2008) study states that *the effects of changes in starting and landing fees on the behaviour of airlines were rather limited.* This observation was also supported by TRKC (2010). One possible reason is that the landing fees compose only one of many other charges, such as the fees for designation of landing points and slot trading. Besides, airlines choices may also be influenced by other factors, because air travel market is in expansion. When it comes to the LCC, though, landing charges may have a greater impact, because they account for greater share of their total operating costs, and also might be difficult to pass on to consumers. Impacts of landing fees on the traditional carriers' airports choices are more difficult to pinpoint. Passenger taxes revenue is assigned to central governments while aviation charges including landing and handling fees remain within the sector and may be use to improve airport capacity. This doesn't mean, however, that they are reinvested in the same airport, since cross-subsidization between airports owned by the same authority does occur.

In addition, no consensus prevails as to which is the best approach to promote investment in infrastructure; either the single till which takes into account the aeronautical and the commercial profits of the airport or the dual till. A study by OECD/ITF (2010) claims that at busy airports, the single till principle contributes to low airport charges and low rents for slot owners. However, a study by Malavolti (2010) indicates that the airport charges do not have to be lower when applying the single till principle because they also depend on others factors such the total waiting time and the level of passengers demand. IATA[50] states that the dual till can incentivize airports to invest in potentially higher-return commercial activity rather than the essential aeronautical infrastructure for which airports are specifically built. The new directive on airport charges leaves this issue up to the relevant airports authorities.

Common Aviation Area

According to the EC progress report on the Common Aviation Area an agreement with Morocco within this policy framework has not only contributed to harmonized legislation but has also helped to open its market for European investments. The same document also reports that similar agreements with western Balkans "*have contributed to the increase in the number of passengers and airlines flying on new routes"* (EC 2008/C596), although this, however, does not need exclusively affect the European airlines. Other positive impacts include increased legal certainty for airlines to develop their business in non-European locations. Moreover, market expansion in countries which experienced large traffic growth can also increase demand for services offered by all other carriers. Since skies are global, it is important to involve non-EU countries in SES and SESAR systems. However, enforcement difficulties and ratification's delays by some MS may hinder these benefits to materialize soon. Broader regional alliances incorporating more markets

[50] IATA. Position Paper "Single till is the fairest mechanism of charging airline users" available at http://www.iata.org/policy/charges/Pages/index.aspx

should thus be pursued in longer terms.

The following chart gives a compact overview of the complexity of policy lines within the air transport sector and how these may interact with other issues assessed in other WP of this project.

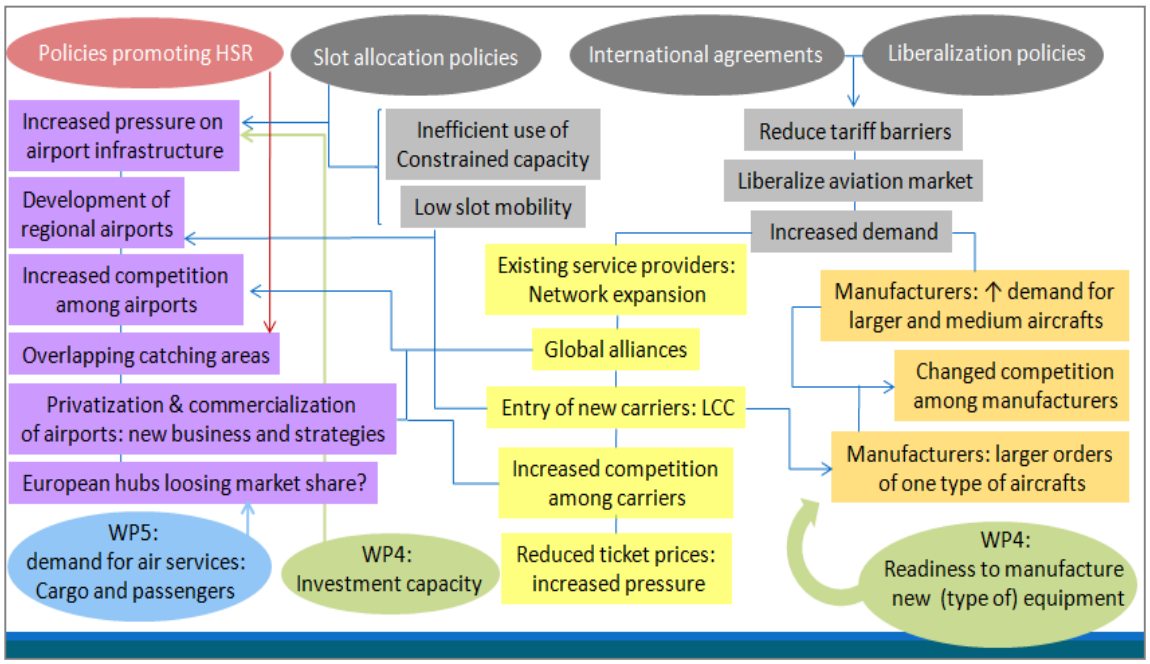


Figure 3: Air transport policy main lines of action and impacts

Impacts of research on industrial outcomes

Collaborative initiatives that enable cooperation through SESAR and other programmes were supported by highly focused applied research which enabled to increase competitiveness of European aviation industry with relatively low-level public funding. It also helped the European industry to retain its high technology position in the global air travel market, and even attain technology advantage against traditional (US) and the emerging countries competitors. Fifty one percent of Integrated Projects and Specific Targeted Research Project funds, all together approaching € 430 million, have been allocated to research targeting improvement of the European aeronautics industry's competitiveness (ACARE 2011).

The ACARE Goals Progress Evaluation (AGAPE 2010) reports the advancements during 2008-2010 towards attainment of the *Vision 2020*goals by in the fields of environmental protection, safety, ATS efficiency, security, and service quality and affordability as compared to the plans for

1. 50% CO2 reduction
2. 80%NOx reduction
3. Reduction of noise emission by half
4. No impacts on people outside the airport boundaries
5. Application of green manufacturing, maintenance and disposal technologies
6. 80% reduction in accident occurrence
7. Minimisation of human error occurrences
8. 3-fold increase in air travel traffic
9. 99% flights within 15 min arrival delay margin

10. Lowering of airport time by at least 15 min (SR) or 30 min (LR)
11. Installation of seamless ATM system
12. Zero successful hijacks
13. Reduction of travel charges
14. Halved time to market and competitive supply chain
15. Increase in passengers choices
16. Improved quality of Air Freight Services

The evaluation has shown that despite the external factors making these goals achievement much more demanding, the research funded by the EU Framework and the national MS programmes, and private sources demonstrated significant progress towards those goals attainment. According to the report, the topics recommended by the SRA are all well covered; the harmonization and integration of European and national projects enabled to complement the different funding sources, conduct research in coherent manner and produce highly relevant results. The SESAR and the Clean Sky initiative (see next chapter) have also contributed to development and early adoption of new technologies.

It is considered that in aviation at least 15 years are needed to create new knowledge through research and development, validate these outcomes technically, demonstrate their applied worthiness, produce proto-types, and subsequently construct new products (ACARE 2011). This means that in order to create the new industrial products one would need to look back to outcomes of research projects performed in late eighties.

Integration of several projects enabled to develop aircraft such as Airbus A380 (2005), Falcon 7X (2005), and more recently, the Eurocopter 175 and AugustaWestland (GRAND 2009).
For instance, the VIVACE- results evolved from industrial simulations which sought to achieve 5% cost reductions in aircraft development, shortening of design phase by 5%, manufacturing lead-time by 30%, and slashing the outlays for development of new or derivative gas turbine engine by 50%. Its main achievement was to create an aeronautical collaborative design environment with associated processes, models and methods for knowledge-enabled engineering, multidisciplinary design and optimization, decision support systems, and engineering data management. It created a large Enterprise information system infrastructure which acted as a collaborative hub for heterogeneous enterprises (VIVACE 2007 and EC 2013 f). A proof of its success consists in that Airbus (which led this scientific undertaking) is to implement these outcomes in design and manufacturing of the forthcoming airplane structures.

4.2.5 Other considerations

Traditionally, the European transport policy deals in different manners with different modes. But since development of pan-European multimodal transport is essential for an efficient European transport system, the common European transport policy favors multimodality. However, attainment of this objective is wrought with barriers. The most current and severe is the lack of global single electronic transport document covering all multimodal transport operations. This deficiency is caused by the different management regimes in different transport modes and the lack of understanding between the different modes operators. Most stakeholders participating in a

consultation[51] recognised that, since logistics and shipping became global, documentation on goods movement should also go beyond European borders in line with shippers' business. A single multimodal bill of lading might simplify administrative procedures of modal shifts, and reduce the related costs and arrival delays, benefitting all respective service providers and their clients.

The key to development of multimodality resides in deployment of Intelligent Transport Systems (ITS). By providing research funding for ITS development, several EU policies created a legal framework needed for its national embedment. Besides in addition to multimodal transport chains, ITS may also be applied to in provision of traffic and travel information (TTI), management of overland traffic and navigation services, smart ticketing and pricing, monitoring safety and security condition, freight transport and logistics visibility, environmental impacts and energy efficiency. To improve traffic and transport efficiency, several applications were developed for road carriage (V2V, V2I, RTTI, RDS-TMC/GSM, TMC and TPEG-TISA), air transport (SESAR, ASA, GS-AS), management and control of maritime traffic (MOS, VTIMS, ISC, ECDIS and RIS) and rail networks (ERTMS, ETCS, GSM-R) (Giannopoulo, Mitsakis and Salanova 2012). The ITS functionality will be enhanced by the European Galileo satellite system which will enable interoperability with two other global satellite navigation systems GPS and GLONASS. New applications will include the electronic fee collection systems, automated vehicle identification and classification technologies, the prepaid or postpaid systems for service ordering, smart pricing and ticketing for the use of transport infrastructure (smartcards), cargo tracking and tracing solutions, and autonomous and co-operative (either passive or active) monitoring of transport safety. Since road transport dominates the occurrence of fatalities (97%), the latter application area will mainly focus on this mode. By reducing delays and environmental impacts and improving predictability and energy efficiency these applications will enhance the quality of European freight transport and logistics. However, before this can happen, several highly consolidated efforts are required to overcome the remaining technical, legal and organizational barriers. This work should concentrate on standardization, interoperability and integration of systems, coordination of information services, network management tools and communication bearers and data warehouses, and location of referencing methods and e-freight applications.

The current economic crisis made the public-private partnerships (PPP) especially relevant for the large-scale ITS investments because funding of such an expensive project exceeds capability of one single party. Although PPPs involve higher borrowing costs, they still can bring about many additional advantages. The PPP costs of private funding for the long-term ITS investments may become less onerous when additional outlays are annualised over longer depreciation period reducing thus the immediate payback pressures. This will however, require that private-sector interests is carefully aligned with those of the European policy objectives, that outputs are exactly defined *a priori* and that the project progression is carefully monitored all the way to its fruition. In this way the private-sector expertise can be harnessed and applied for sharing risk and costs

[51] Gomez-Acebo & Pombo, Abogados SCP. 2009. Study on the details and added value of establishing a (optional) single transport (electronic) document for all carriage of goods, irrespective of mode, as well as a standard liability clause (voluntary liability regime), with regard to their ability to facilitate multimodal freight transport and enhance the framework offered by multimodal waybills and or multimodal manifests. Gomez-Acebo & Pombo, Abogados SCP for DG Energy and Transport under Framework Contract "TREN/CC/01-2005 Lot 1 Legal assistance activities

between private and public investors (Dhéret, Martens and Zuleeg 2012)[52].

4.3 Assessment of impacts

The review of impacts has shown that the expected large-scale freight and passenger shift from road to rail has not yet happened. The most recent rail legislation has concentrated in harmonization of technical standards to ensure interoperability and deployment of ERTMS. Though this occurred at quite slow pace some positive effects were registered such as an increased interest for and application of ERTMS in non-European markets. This may obliterate the home-grown skepticism that ERTM was too demanding and too costly to be broadly deployed within the EU. Both ERTMS and TEN-T project facilitated development of HSR which to some extent, managed to attract passengers from domestic flights, but also lost some passenger segments to LCC. European transport policies were not as successful as expected in increasing the market share of rail services but binding legislation and research initiatives and projects supported and/or co-funded by the EU have contributed to develop infrastructure and develop the necessary technology to offer more competitive rail services likely to gain a foothold in global markets. No explicit impacts of the most recent legislation could have been traced on competitiveness of freight rail operators and equipment providers. Yet, it could be deduced that some previous policies seem to be paying off, because the European rail equipment and systems manufacturers still exports over fifty percent of their output to non-European markets.

As regards the road transport it is unclear if the regulation (2009) regarding access to international coach bus markets has effectively removed the formal and informal cabotage barriers since no study on this issue could be found. Assessment of whether the legislation regulating the market for cabotage in road haulage made some progress has also proven difficult, since its success depends also on openings of several other mode markets. Furthermore, the different ways how the MS enforced this legislation nationally even within the core EU-15, and the impacts of the current economic crisis might have reduced, slowed down, stopped or even increased the scale and the magnitude of efficiencies attained. The impacts sought by the road charging schemes such asimproved scheduling, higher vehicle utilization, higher levels of investment in new technologies and environmentally-driven fleet renewal are expected to be greater in the freight and logistics segments than in passenger road transport. The impacts of such policies on the global competitiveness of the industry are uncertain since they mainly apply within Europe and scope reducing environmental footprint of road transport. On the other hand, precisely this scope may push innovation and prepare the industry to confront future constraints while sophisticate business models may be developed as a consequence of increased access to international markets.

In the waterborne sector there is concern that harmonization and verification of technical requirements regarding fleet management and electronic reporting activities to improve the IWW efficiency and effectiveness may be colliding with similar road and rail promotion policies. The

[52] Dhéret, C. , Martens, H. and Zuleeg, F. Can PPP lever investment to get Europe out of the crisis. EPC Issue Paper No. 71. European Policy Center.
http://www.epc.eu/documents/uploads/pub_3066_can_public_private_partnerships_lever_investment_to_get_europe_out_of_economic_crisis.pdf

issue is how the IWW, road and rail can complement each other rather than compete. Here, the legislation promoting the multimodal and intermodal solutions has delivered some positive effects, although participation of IWW in trans-European and extra-European supply chains is limited to some few countries (the Netherlands, Germany, Austria, and Hungary) and European gate ports (Hamburg, Zeebrugge, Rotterdam and Bremerhaven) and constrained by seasonality of voyage opportunities and the lack of investments in modernization of IWW ports, fleet, and river/channel infrastructure. Besides, even if benefits do derived from IWW promoting policies, it is still questionable whether they will affect the competitiveness of the European transport industry at a global level, and will depend on the role of IWW as a part of the global value chain. That is not the case for maritime services since these are mostly global services per se. Attracting skilled workforce and setting global safety and security standards may give European flags the comparative advantage to balance their higher costs compared to foreign flags.

Improvement in competitiveness of European air transport is still saddled with problems caused by high growth in air traffic achieved through the past industry liberalisation policy, and the lack of investments in matching expansion of airport capacity at major European air travel hubs and progression in ATM and SES deployments. Besides, several constraints such as the lack of free market mechanisms hinder improvement of slot allocation effectiveness and efficient slot capacity utilization at Europe's most busy airports. Yet, the research reviewed differs in opinions whether further liberalization might or might not better address these issues. At any case European hubs risk to fall out of main global corridors if service providers and airports are not able to jointly cope with those challenges. This might affect the aircraft manufacturing industry or not, depending on its customers' diversification around the globe.

Transport policies targeting one specific transport mode can exert both positive and negative impacts on other transport sectors. As mentioned, road and rail subsidies can have implications for short sea shipping, air liberalisation may affect rail industry and development of HSR may decrease demand for domestic air travel, but also the other way round. Furthermore, due to investments and the consequent development of public mass-transit, the use of car has fallen in many European cities.[53] Such crossed-sectoral outcomes prove that attainment of important policy goals requires adoption of several and different fields of transport legislation and mobilization of multiple highly concerted efforts[54].

As regards results from investments in research devoted to European transport, this review has shown that research-driven developments of new technologies, new applications and new materials and propulsion systems novel systemic solutions may be applied by both the equipment manufacturing and the service provision industry. Putting into operation new manufacturing

[53] The Economist. 2012 *The future of Driving. Seeing the back of the Car.* September 12, 2012. http://www.economist.com/node/21563280

[54] The Eurovignette Directive (as proposed by COM (2008) 436) shows how slow and hard can be the implementation of new legislation, when several actors involve in the process. In this case revenue redistribution was the main cause of disagreement. IRU and the International Automobile Federation claimed that it should redistributed on the road transport sector and infrastructure improvements, MS argued that they would not be able to compensate hauliers for the financial burden, the Community of European Railways called for even higher charges and the European Federation for Transport, the Environment said that proposed pricing was insufficient to cover external costs and the International Association of Public Transport expressed wishes to extend infrastructure pricing policy to private cars and urban areas.

processes, techniques, robotics applications, advanced innovative materials, computer reservation systems and information technologies can enhance safety and security and efficiency standards, and thereby improve the European transport industry's global competitive standing.

Finally, one needs to observe that although assessment of impacts which the European transport policies imposed on other goals than the industry's global competitiveness is outside the remit of this report, we should also keep in mind that positive effects on one type of industry might not necessarily positively affect the other socio-political objectives such as spatial equity, intra-European cohesion, regional integration or environmental sustainability[55]. Since these issues also have implications for global competitiveness of European transport industry, it is important that the findings summarized below are interpreted very cautiously.

4.4 Summary of impacts

The following tables summarize the direct and indirect impacts of binding and non-binding legislations previously assessed.

Table 4: Summary of direct impacts of legislation

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Air	ATM and air navigation	Regulation (EU) No 677/2011	Heighten efficiency in use of airspace in the SES area and ensure that airspace users obtains maximum access to airspaces and air navigation services and can operate preferred trajectories	Reduction of routes' length, costs, delays and environmental impacts; increased air traffic capacity and volumes as well as safety; changes in aircrafts and routes structure; transfer some of the responsibility of operating those systems from airports onto airlines
Air	ATM and air navigation	Regulation (EU) No 176/2011	Establish the requirements for the information (and procedure) to be provided by the MS to the Commission, the European Aviation Safety Agency (EASA), other Member States and interested parties before the establishment and modification of a functional airspace block	
Air	SES Performance Scheme	Regulation (EU) No 1216/2011	Amending deadlines regarding the assessment of the revised performance targets and adoption of corrective measures by the Comission and target setting for Safety KPI For national or Functional Airspace Block (FAB)	Lowering of the targets by MS and delays in deployment of SES are preventing the airline industry from benefiting from the benefits mentioned above. Negative effects are increased unit economic costs due to the increase in costs of ATFM delays related to the gate-to-gate phase as well as environmental protection. Some positive effects such as the reduction of unit ATM/CNS financial provision costs and savings from deployment of
Air	SES Performance Scheme	Regulation (EU) No 691/2010	Improve the overall performance of air navigation services and network functions for general air traffic within the ICAO EUR and AFI regions by setting and implementing binding targets for EU Member States in the key performance areas of safety, environment, airspace capacity and cost efficiency through the adoption of European-Union wide performance targets	

[55] See for instance ESPON 2006. *Territorial Impact of EU Transport and TEN Policies*. Luxembourg: ESPON and (Mott MacDonald 2012)

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
			and approval of consistent National or Functional Airspace Blocks (FAB) performance plans	consistent containment measures could be emphasized
Air	SES Performance Scheme	Regulation (EU) No 1191/2010	Ensure transparency and consultation on how air navigation services provision costs are calculated and split between the various services and improve the cost efficiency of the provision of such services	
Air	Single European Sky II	Regulation (EU) No 255/2010	Optimise the available capacity of the European air traffic management network (hereinafter EATMN) and enhance ATFM processes	
Air	Single European Sky II	Regulation (EU) No 73/2010	Ensure the quality of aeronautical data and aeronautical information for the single European sky in terms of accuracy, resolution and integrity.	
Air	Single European Sky II	Regulation (EC) No 1070/2009	Complete the creation of the single European sky, improve the performance of the European aviation system in the areas of safety, environment, capacity and cost-efficiency, and adapt the single European sky legislation to technical progress	
Air	Single European Sky II	Regulation (EC) No 262/2009	Establish the requirements for the coordinated allocation and use of Mode S interrogator codes (hereinafter interrogator codes) for the purposes of the safe and efficient operation of air traffic surveillance and civil-military coordination	
Air	Single European Sky II	Regulation (EC) No 29/2009	Establish the requirements for the coordinated introduction of data link services based on air-ground point-to-point data communications to improve the efficiency of communications between pilots and controllers and enable the provision of additional air traffic control capacity	
Air	Single European Sky II	Communication COM(2008) 389	Make a proposal to meet the challenge of large increases in air traffic expected in the coming years, increase security, reduce costs, delays and the impact of air traffic on the environment	
Air	SESAR Initiative	Regulation (EC) No 1361/2008	Bring together European Union (EU) research and development efforts within the framework of the Single European Sky Air Traffic Management Research project to ensure modernisation of the European air traffic management system and develop an ATM capable of ensuring safety and fluidity of air transport worldwide over the next 30 years	Optimised use of public funding and technology maturation. Specific expected impacts include a combined economic positive impact of € 419 bn over the period, 328.000 additional jobs on direct, 10% reduction on flight times and 50% fewer cancellations and delays, and positive net effect on total CO2 emissions from 2014 to 2030 despite the additional increase on air traffic.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Air	Safety Management Systems	Regulation (EC) No 482/2008	Reduce the risks associated with the use of software in the European Air Traffic Management network systems by establishing the requirements for the implementation of a software safety assurance system by air traffic service (ATS) providers, entities providing air traffic flow management (ATFM) and air space management (ASM) for general air traffic, and providers of communication, navigation and surveillance (CNS) services	Enhance the correct functioning of ATM systems with all the benefits that derived from it (described above)
Air	Airport charges	Directive 2009/12/EC	Establish a common framework regulating airport charges at European Union airports	Increased operation costs, especially for LCC due to the greater share of airport charges in LCC's operation costs
Air	Liberalization	Regulation (EC) No 1008/2008	Define the granting of operating licences, the monitoring of airlines and their access to the market, and guarantee a competitive air transport market, quality services and more transparent fares	Facilitated accessibility to air transport and air traffic growth with increased demand of services and airplanes. Entrance of LCCs have increased competition among airlines and changed the characteristics of airplanes orders to manufacturers, thus influencing the competition among those. They have also led to adapt infrastructures of regional airports
Air	Airport allocation of slots	Proposal for a Regulation COM(2011) 827	Ensure that airlines can make the best use of the available capacity	The expected outcomes are not unanimous. The positive expected effects would be that increase competition would increase efficiency at a relative low administrative cost and benefits derived from secondary trading for airlines along with increased number of passengers and a fare reduction. Among the negative effects we found leakages of the majority of the benefits outside the EU as it would specially benefit non EU airlines (but also new entrants); adverse impacts on carriers operating regional services as a consequence of a decline of such; challenges for the airport infrastructure of main hubs as the measure would encourage the order of larger aircrafts and a decline of the smaller ones
Air	Airport allocation of slots	Regulation (EC) No 545/2009	Suspension of the "use it or lose it" rule due to the economic crisis to allow air carriers to keep the same slots for the summer season of 2010 as attributed to them for the summer season of 2009	Sub-optimal use of constrained slot capacity; decreased investment in airport capacity expansion; prevent traffic growth and fare reduction; development of services at secondary airports
Air	Harmonization of requirements and procedures	Regulation (EC) No 859/2008	Ensure a high level of safety and improve the functioning of the internal market by incorporating into EU legislation the technical requirements and administrative procedures in the field of aviation, as drawn up by the Joint Aviation Authorities (JAA), and requiring EU countries to comply with them	Providing minimum safety levels may increase public confidence in air services and harmonization of requirements may reduce administrative costs

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Air	Common Aviation Area	Communication COM (2008) 596	Allow gradual market opening between the EU and its neighbours through the gradual implementation of EU aviation rules and the promotion of fair competition and the implementation of common high safety, security, environmental and other standards	Open up new market possibilities to establish new routes and make investments in foreign markets to diversify revenue sources
Rail	Rail network for competitive freight	Regulation (EU) No 913/2010	Improve the efficiency of rail freight transport relative to other modes of transport, ensure coordination between MS and infrastructure managers to guarantee functioning, sets out rules for the selection, organisation, management and the indicative investment planning in infrastructure and technical equipment, and increase rail freight capacity and efficiency	No studies found regarding the impact of this regulation on the competitiveness of the European transport industry but research on previous liberalization and market opening policies showed that MS that have implemented such policies experienced an upturn in freight growth
Rail	Interoperability, TS, ERTMS	Decision 2012/696/EU	Ensure the interoperability of the trans-European rail system and compliance with the essential requirements in order to: harmonise the MS's rail systems, create an interoperable European network, enable the movement of people and goods, and promote the railways as a mode of transport	Increased capacity; decreased operational costs; improved efficiency; improved operational safety; more competitive prices; contribute to internasionalisation through the increasing global demand for ERTMS; new orders and market possibilities for European suppliers, partly due to the diversification of ERTMS applications; infrastructure improvements; opening up of possibilities for the development of new intercontinental rail freight services into Asia.
Rail	Interoperability, TS, ERTMS	Decision 2009/561/EC	Integrate and harmonise the technical standards applying to conventional rail systems, enable people and goods to move around more easily, promote the railways as a mode of transport in Europe.	
Rail	Interoperability, TS, ERTMS	Directive 2008/57/EC	Achieve interoperability within the EU rail system at the design, construction, placing into service, upgrading, renewal, operation and maintenance stages and accelerate the integration of the EU rail network through increased technical harmonisation, guaranteeing a high level of safety	
Rail	Interoperability, TS, ERTMS	Decision 2008/386/EC	Adapt TS to technical progress to harmonise the technical standards applying to conventional and high-speed rail systems, enable people and goods to move around more easily, promote the railways as a mode of transport in Europe	
Rail	Interoperability, TS, ERTMS	Decision 2008/217/EC	Establish TS related to the infrastructure sub-system of high speed rail system to harmonise the technical standards, enable people and goods to move around more easily, promote the railways as a mode of transport in Europe	
Rail	Interoperability, TS, ERTMS	Decision 2008/164/EC	Establish TS related to persons with reduced mobility to harmonise the technical standards applying to conventional and high-speed rail systems, enable people and goods to move around more easily, promote the railways as a mode of transport in Europe	
Rail	Interoperability, TS, ERTMS	Decision 2008/163/EC	Establish TS related to safety in railway tunnels to harmonise the technical standards applying to conventional and high -speed rail systems, enable people and goods to move around more easily, promote the railways as a mode of transport in Europe	

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Rail	Multi-annual contracts	Communication COM(2008) 54	Optimise the quality of Community transport infrastructures through long-term financing arrangement	Ensuring a certain level of certainty with regards infrastructure development may encourage rail operators to make the necessary investments and may help the rail manufacturing industry to be better prepared to cope with future demands of equipment
Road	Charging for the use of infrastructure and internalization of external costs	Communication COM(2012) 199	Provide guidance on the application of a vignette system for light private vehicles in line with the EU principles of non-discrimination and proportionality of the Treaty to: ensure better use of the infrastructure, reduce its negative impact on the environment, increase awareness of the impact of their mobility choices among users	Impacts are described as negligible regards the competitiveness of the European transport industry. These are the generation of revenues for operators serving alternative transport modes and a certain influence the purchase behaviour of customers when buying a vehicle, thus, shyly thriving the production of more environmental vehicles and innovation in the manufacturing industry
Road	Charging for the use of infrastructure and internalization of external costs	Directive 2011/76/EU	Improve the functioning of the road transport internal market by reducing the differences in the levels and systems of tolls and vignettes applicable in Member States and take better account of the principles of fair and efficient pricing by providing for greater differentiation of tolls and vignettes in line with costs associated with the road use	For road hauliers this regulation may contribute to gains in efficiency and reliability (i.e. selection of alternative routes, improved vehicle utilisation and scheduling and reduced leading times), higher investments in technological improvements and fleet renewal, and organizational changes. This would also influence the whole transport chain and increase the efficiency of logistic companies, which could also choose alternative transport modes if road hauliers do not prove to be competitive enough. The manufacturing industry may experience an increased interest for innovative engines that reduce fuel consumption.
Road	Charging for the use of infrastructure and internalization of external costs	Proposal COM(2008) 436	Encourage Member States to implement differentiated charging to improve the efficiency and environmental performance of road freight transport which in turn will promote the use of cleaner vehicles, the selection of less congested routes, the optimisation vehicle loading , and ultimately to the efficient use of infrastructure	
Road	International access	Regulation (EC) No 1072/2009	Establish the rules for access to the international carriage of goods by road and the conditions under which non-resident hauliers may operate transport services within an EU country	Impacts across Europe are unclear. It can contribute to a possible efficiency loss, act as barrier to full liberalisation and increased competition and even decrease competitiveness of some MS's industries But it can also: reduce the administrative costs, limit the barriers established by MS and bring along increased efficiency levels as a result of the adoption of high standards for quality, reliability and punctuality
Road	International access	Regulation (EC) No 1073/2009	Clarify and simplify the rules for the international carriage of passengers by road within the territory of the European Union (EU) and the conditions under which non-resident carriers may operate national transport services within an EU country	No studies were found on impacts. Unclear how new legislation has contributed or not to relief bad practices and barriers (regulatory restrictions, unfair intermodal competition, vertical integration of operators and terminals, long concession periods to existent operators, complex criteria to acquire new concessions and discrimination in

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
				favor of incumbents)
Water borne	Integrated Maritime Policy	Regulation (EU) No 1255/2011	Provide funding for the priorites of the Integrated Maritime Policy Agenda which are focused on Issues that do not fall under a single sector-based policy e.g. "blue growth" (economic growth based on different maritime sectors). Issues that require the coordination of different sectors and actors e.g. marine knowledge	No evidence of impacts could be found but the following issues promoted within this regulation can have positive impacts in bridging the gap between research and industry: simplification and harmonisation of procedures, financial support given to research activities, improved governance mechanisms
Water borne	Integrated Maritime Policy	Proposal COM(2010) 494	Provide adequate finances for further developing and implementing the Integrated Maritime Policy.	No evidence of impacts could be found but we believe that the following achievements can have positive impacts in bridging the gap between research and industry: simplification and harmonisation of procedures, financial support given to research activities, improved governance mechanisms
Water borne	Harmonization of River Information Services (RIS)	Regulation (EU) No 164/2010	Support RIS (river information services) which enhance the safety, efficiency and environmental friendliness of inland waterway transport as well as to ensure compatibility and interoperability with other modes of transport	No study was found reporting on the effects of this legislation but possible impacts of specifying the technical specifications of electronic ship reporting in inland navigation, harmonizing reporting activities and laying down technical requirements for inland waterway vessels could be: reduced operational and standby transport costs, fewer accidents and, thus, insurance costs, reduced logistics costs and improved services thanks to the positive effects on the efficiency of terminal authorities
Water borne	Harmonization of administrative procedures by establishing a standard electronic transmission of information and rationalizing reporting formalities.	Directive 2010/65/EU	Simplify and harmonise the administrative procedures applied to maritime transport by making the electronic transmission of information standard and by rationalising reporting formalities	
Water borne	Technical requirements	Directive 2009/46/EC	Promote European river transport by improving the technical harmonisation of vessels	
Water borne	Maritime Transport	Communication COM (2009) 8	Presentation of the main strategic goals for the European maritime transport system up to 2018 and to identify key areas for action where action by the EU will strengthen the competitiveness of the sector while enhancing its environmental performance.	The development of a SRA may help the industry to coordinate efforts working to pursue a common goal as well as to increase its capability to adapt to future needs
All	Competitive and sustainable transport system	White Paper and Impact assessment Communication COM (2011) 144 SEC(2011) 358	Definition of actions and measures to follow and goals to achieve for a competitive and resource efficient transport system with a 60% GHG emission reduction target	Dealing and trying to solve such problems may increase the technological readiness of the transport industry to adapt to future constraints that globally are being insufficiently addressed as they do not seem to represent (yet) a real threat.
All	Connecting Europe Facility	Proposal for a Regulation Communication	Remove bottlenecks and bridge missing links, ensure sustainable and efficient transport in the long run, optimise the integration and interconnection of transport modes and enhance interoperability, safety	This objectives may be relevant as far as they are integrated in global transport flows (i. e. for transport companies that provide services globally in which the European

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the transport industry's competitiveness
		COM (2011) 665	and security of transport services.	segment plays a crucial role)
All	European Transport Expansion	Strategy and Impact assessment Communication COM (2009) 301	contribute to facilitating transport flows between Africa and Europe, extending trans-European networks towards Africa and the partnership on infrastructures in the field of transport services (particularly by providing our partners with access to the experience and best practice of the common transport policy)	New market possibilities for European manufacturers of transport equipment as African transport services increase demand for equipment that might not be available in the regional market. Facilitation of custom and cross-border procedures for European transport service providers may open-up new routes for passenger and freight
All	Internalization of external costs	Communication COM(2008) 435 SEC(2008) 2208	contribute to make transport more sustainable by including external transport costs (pollution, noise, congestion, etc.) in the price paid by the user, so as to encourage them to change their behaviour	This might generally thrive technological readiness of the transport industry

Table 5: Summary of outcomes of research activities

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Air	ACARE GoAls Progress Evaluation (AGAPE)	demonstrate that the process set by ACARE with respect to the SRA has proved efficient for the period 2000 – 2010 in advancing the progress towards the Vision 2020 objectives: meet society's needs for an efficient air transport system and achieve global leadership for Europe in civil aviation	Evaluating the progress made helps identify the issues which should be enhanced
Air	Value Improvement through a Virtual Aeronautical Collaborative Enterprise (VIVACE)	Construction and dissemination of the "Behavioural Digital Aircraft" Model, which enables the stakeholders to work together in the virtual design of the aircraft	Avoiding multiple interfaces between different software and databases will halve the time to market new products, increase the integration of the supply chain and decrease travel charges. A proof of success is that Airbus (which led the project) is committed to implement these practices in the design and engineering structures
Rail	MARATHON	The project is still ongoing. The project investigates the combination of rolling stock technologies with innovative operating patterns by coupling together at specific locations trains or wagons into one consist. It will show the shows the effectiveness of operating faster, longer and heavier freight trains on selected European routes	Service and cost benefits (driving the rail freight service modernization)
Rail	Operating Project for a European Rail Freight Network (NEW OPERA)	Developing a 2020 scenario, identifying key factors and giving recommendations to face the new competitive business environment, optimisation of operational and technological aspects, network and interoperability needs and new products and services. A Socio Economic Evaluation was also taken into account	Revitalise the rail industry, increase productivity and efficiency gains and provide the freight transport industry with a more competitive transport option
Rail	SAFERRAIL	demonstration of the successful operation of several project prototypes designed to identify faulty axles, wheels and suspension	Increase the reliability of rolling stock operations and contribute towards the optimisation of operations' cost efficiency by means of: minimising wheelset failures that also improve safety

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Rail	RAILENERGY	cut the energy consumption by developing a holistic framework approach, new concepts and integrated technical and technological solutions to improve energy efficiency	reduce energy consumption (6% by 2020) and optimise railway system which shall reduce the operational life cycle costs and CO2 emissions per seat/kilometre or tonne/kilometre
Rail	TRIOTRAIN: DYNOTRAIN, PANTOTRAIN, AEROTRAIN	Projects are still ongoing. They check for inconsistencies and open points in the existing criteria for certification of rail vehicles, propose revisions of criteria in European standards and resolutions to open points in the TSI, and a new computer simulation/virtual homologation regarding Railway Dynamics and Track Interaction (DYNO), Aerodynamics (AERO) and Pantograph/Catenary Interaction (PANTO)	time reduction (from 24 to 6 months) and decreased costs associated with certification without reducing the safety level (estimated financial savings of 20-50 million/year)
Rail	INTERRAIL	eliminate rail failures by developing and implementing an integrated high-speed system application for the fast and reliable inspection of rail tracks and a novel semi-automated testing equipment evaluation of the defects detected during high-speed inspection	avoid loss of confidence in rail transport by the general public by minimizing or even avoiding disruption and unnecessary costs and improving safety
Rail	RAILECT	development of a rapid ultrasonic method for the safe and reliable NDT examination of the entire volume of in-situ alumino-thermic rail welds	avoid rail failures caused by weld failures (20% of the total 7000 failures/year) which may reduce economic losses of rail operators and increase reliability on services (as safety is also enhanced)
Rail	INESS INtegrated European signalling system	define, develop and standardise specifications for a new generation of interlocking systems including development of business and cooperation models to support migration strategies for ERTMS	reduced life-cycle costs of future interlocking and associated outdoor equipment which may release financial resources for making other necessary investments. Standardisation may significantly reduce constraints for suppliers. Safety may increased translating into a greater confidence in rail services.
Rail	CREAM Customer-driven rail-freight services on a European mega-corridor based on advanced business and operating models	Organisational improvements on quality management for international freight trains, interoperable traction schemes and streamlining border crossing procedures; provision with technical solutions for tracking of trains and wagons, IT Train Monitor system, new transshipment system for conventional semi-trailers “ISU”, intermodal semi-trailer for glass loads “FLOATRAILER”, and dual-power locomotive concept “FUTURA”; and improved rail freight transport offers	general increased attractiveness of international rail freight transport
Rail	RETRACK Reorganisation of transport networks by advanced rail freight concepts	Secure a significant modal shift of cargo from road to rail and to create an effective and scalable rail freight corridor between high demand regions in Western Europe and new high growth regions in Central and Eastern Europe.	general increased attractiveness of international rail freight transport
Road	ROADIDEA	Roadmap to a more innovative and competitive European transport service sector	New and innovative transport services due to the performance of pilot projects on road slipperiness fog, rain, prediction, and a combination of weather and traffic flows predictions and prediction tool for the generation and distribution of road traffic depending on the ship arrivals and departures.
Water borne	MARSTRUCT Network of Excellence	Strengthen European shipbuilding competitiveness through a programme for jointly executed research in the area of structural analysis of ships, the creation of research facilities and platforms and a continuous programme of dissemination	The establishment of the MARSTRUCT Virtual Institute contributes to improve the comfort, effectiveness, safety, reliability and behaviour of ship structures and improve the knowledge on materials and fabrication of structures, as well as on methods and tools for structure design and optimisation and tools to assess loads and load effects and structural fatigue of ageing ships
Water borne	IMPROVE	Design of 3 improved, competitive and new ship generations (LNG gas carrier, Ro-Pax vessel and chemical tanker) by applying a decision support system that integrates structure, production, operational aspects, performance, and safety criteria	Reduction of operation costs and fuel consumption and increase usage of cheaper and more resistant materials to corrosion

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Water borne	VIRTUE	Provided improved available computational fluid dynamics (CFD) computer programs to develop a virtual ship basin, an integration platform to combine different tools, and best practice guidelines providing support to the CFD specialists and naval architects for four application cases: towing tank, seakeeping tank, and manoeuvring and cavitation tank.	Improve the performance of vessels
Water borne	InterSHIP	Integrated tool and methods for design and manufacturing of cruise, passenger ships and RoPax to optimise all steps of the production chain and the total life-cycle of such vessels. It also improved vertical integration between shipyards, owners, suppliers, classification societies and horizontal cooperation between EU shipyards	* minimize costs in the hull production process by: -reducing welding distortion and rework in hull production thanks to a laserarc hybrid welding prototype system; -increased productivity and quality thanks to automation and reduction of dead times gained by a for the production of subassemblies robotised system formed by a a scanner, a fitting station, and a welding station (a redution of 1,6 m€ per typical cruise ship is estimated with the installation of two robotised stations); -development of an accuracy management system to perform measurements for hull shrinkage compensation. *improved information about project status and progress thanks to a operational analysis system * improved knowledge about modular ship concepts (solutions for machinery and accomodation and public spaces), * promote data exchange, integration and collaboration regarding logistics and material tracing in shipyards; * facilitate a smoother and more reliable procurement process and business transactions thanks to optimisation of e-HUBs value chain, standardisation for ERP integration * demonstration for Bringing Connectivity to users on board Ship during Manufacturing Phase * provision of innovative and alternative solutions to decrease the cable length pulled onboard passengers ships and to enable the penetration of Mobile ITC onboard ship all along their life cycle
Water borne	DOKLASER	Development of a mobile laser hybrid welding equipment to be used in the dock area of the shipyard	Faster welding and fewer distortions may reduce the costs derived from maintenance.
Water borne	BONDSHIP	Tested the use of adhesives in areas of the shipbuilding where welding techniques are not ideal	smooth surfaces that do not need to finishing work afterwards, saving 30% of productions costs; guidelines for design, modelling, testing, production, fire protection, inspection and repair of bonded joints
Water borne	CREATE3S	Development of creative design & production concepts based on modularisation leading to an innovative ship concept consisting of two basic modules: a ship platform module and interchangeable cargo-containing module	The project contributes to a more efficient freight management, reduction of times at ports and a better link with inland waterways by assembling the cargo barges into push units
Water borne	BESST	The project is still ongoing. It researches the development of innovative vessels (cruise ships, ferries and mega yachts) while also cutting the vessels' environmental impacts and improving safety and security; It also works at creating a ship life-cycle performance assessment tool to evaluate the pros and cons of any technical innovation over the entire lifespan of the ship.	By reducing the total life-cycle costs of European-built ships - around EUR120 million over a 30-year lifetime and cut CO2 emissions by 12% shall make the higher purchase of an European manufactured ship worth.
Water borne	FANTASTIC	Development of computational fluid dynamics (CFD) tools	Optimisation of hull forms may have positive impacts on the operational cost-efficiency of maritime services
All	iTREN-2030	Integration of 4 models (ASTRA, POLES, TREMOVE and TRANSTOOLS) into one model system of transport, economics, energy and the environment to develop integrated scenarios and serve as tool for policy makers	Use the model to find out changes caused by implementation of policy measures, may help industry and policy makers to learn from past failures and successes when designing new policies

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
All	IMplementing Pricing Reforms IN Transport - NETworking (IMPRINT NET)	Effects of pricing reforms policies and recommendations about how to implement pricing reforms in the transport sector	Provide companies and industry in general with a better understanding of the impacts of charging reforms.
Inter-modal	BE-LOGIC Benchmarking logistics and co-modality	development of an e-tool that aims to support a company's search for potential strategic improvements due to a modal change	Provide cargo and logistic companies with a tool to investigate the impacts of a modal shift on time, cost, flexibility, reliability, quality and sustainability criteria and see if a modal shift helps them to 'green' their supply chain, while keeping other performance criteria at least at the same level.
Rail, Maritime, Aviation	EX-TREMIS	database that brings together information on non-road transport vehicle emission and energy factors (consumption) and activity statistics (fleet and transport activity data) to estimate the energy consumption and emissions	Access to the web-based interface and the projections up to 2030 may enable companies to predict energy consumption and emissions enhancing their capability to adapt to new legislative requirements or energy constraints.
Road, Rail, Metro and Tram, IWW and Air	TREMOVE	policy assessment model: simulation model that estimates the transport demand, the modal split, the vehicle stock turnover, the emissions of air pollutants and the welfare level under different policies scenarios	The model may help the industry to predict changes caused by implementation of policy measures and adapt to them.
Road, Rail, Metro and Tram	CityMobil	achieve a more effective organisation of urban transport, resulting in a more rational use of motorised traffic with less congestion and pollution, safer driving, a higher quality of living and an enhanced integration with spatial development	Identify barriers that prevented large scale implementations of automated systems
Urban (light Rail, Tram and Metro)	URBAN TRACK	deliver an integrated series of modular track infrastructure solutions at low cost, with no or little maintenance, high availability, constant comfort and ensuring great punctuality,in an environmentally friendly and safe manner	Urban services attractiveness on tracks may increased thanks to technology advancements and increased quality, and operational costs may be reduced through five innovative products (prefabricated track modules, green LRT / tram tracks, embedded metro tracks, low cost tracks for floating slab in tunnel and at grade, maintenance free interface between rail and street pavement for embedded tracks). The above may increase demand for equipment from the manufacturing industry, which may as well reduce production costs thanks to the harmonization of standards with regards to rail transit track inspection and maintenance, LCC calculation method and functional performance specifications, which are some of the projects' outputs.
Urban (Tram)	PMNIDEA Predictive Maintenance employing Non-intrusive Inspection & Data Analysis	Contribute towards the realisation of a 24 x 7 railway by minimising the disruption caused by activities such as inspection, remedial and reactive maintenance, and track renewal, and introduce novel sensor and inspection technologies which focus more on the monitoring of degradation through the measurement of deviation from identified benchmark data known as a "signature tune".	Increase the effective availability of the track infrastructure as well as the life of new or renovated assets, reduce maintenance costs, provide a high quality reliable service, promote the use of urban transport, and tramways in particular, which contributes to lowering congestion and the impact on the environment. This may increase demand for such services and, thus, their equipment.

5. Environmental policy (VTM)

The EU plays s a central role as regards global environmental protection although environmental policy is a relatively recent EU policy area. The first European Environmental Action Plan (EAP) was launched in 1973 following the Paris Summit meeting, soon after the 1958 Treaty of Rome. But in 1986 The Single European Act has determined that environmental protection should be considered in all new Community legislations, levelling eco-sustainability with economic and social objectives.

The first European Environmental Action Plan (1973) outlined a holistic concept of sustainable development, but the orientation of this strategy was on ecological issues and patterns of industry behaviours over the last two decades. However, the phases of economic cycles have strongly influenced the EU environmental policy, especially as regards direct restrictions, command and control regimes and tax provisions.

The EU environmental policy is an outcome of complex multi-layered negotiations between the member states, a multitude of EU institutions, and special interest advocacy groups, including NGOs. On average, 80% of each member state's environmental legislation is determined by the EU.

5.1 Main environmental policies

The European Union has played an active role in global environmental protection. It has also been a front runner impacting several developments that structured the international environmental agenda. The United Nations Conference on the Human Environment, in Stockholm in 1972, organised by the government of Sweden, triggered a turning point in international environmental politics. (Baylis e Smith 2005). Another marking point was establishment in 1983 of the United Nations World Commission on Environment and Development (WCED), which in 1987 published *Our Common Future*, also known as Brundtland report. This publication presented the first definition of sustainable development, describing it as the "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987). Another cornerstone was the Stern Review on the Economics of the Climate Change released in 2006. It states that "Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen" (Stern e HM Treasury 2006). It concludes that the benefits of strong, early action on climate change outweigh the costs of increased risks of serious, irreversible impacts from climate change associated with current levels of emission. This document received positive, but also critical response; it is still referred to in some legislations.

The part of the EU environmental policies that deals with transportation sector focuses mainly on air quality, climate change, and noise, and to some extent, also on waste and resource efficiency.

The recent legislation tries to harmonise three vectors of sustainable development: 1) economic growth and competitiveness; 2) needs for social welfare, including protection of population's health and growth of mobility; and 3) environmental concerns. Attainment of these objectives is not easy.

Protection of population's health without restrictions on mobility and transport traffic growth may generate conflict, and also harm economic growth and competitiveness. Thus, win-win solutions need to be devised to accomplish these goals with affordable measures. Therefore, the EU and the member states reached a consensus that solutions could be found in applications of new technologies along with restructuring of transportation patterns in passengers and freight traffic, and more environmentally friendly management of infrastructure. As an illustration, new vehicles technologies constrain the levels of allowable emissions. However, these gains have been out-weighted by growth in mobility demand as a consequence of lower travel costs and positive developments in purchasing wealth.

The EU environmental regulators and law enforcement agencies have a variety of policy instruments at their disposal. Since the environmental issue has far reaching social and economic implications and seeks high environmental effectiveness, regulatory instruments such as environmental performance standards and/or emission limits are being used in the OECD countries (OECD 2008). Clean air and climate change policies show that a target-led approach can improve environmental conditions (European Environmental Bureau 2005). However, supporters of market-based instruments, like taxes and trading schemes, claim that the latter are more cost-effective because of better incentives to change the producer and consumer behaviours. Several countries use also public financial support measures, like grants, soft loans or preferential tax treatments to encourage environmental friendly practices through infrastructure investments, technology research and early market-uptake of innovative solutions.

Despite the EU leading role in the global environmental agenda, some critics point out that too many players have a veto power and that legislation has been adjusted to political agendas and also, strongly influenced by economic cycles.

Until 2012, the EU has issued six Environmental Action Plans (EAP) which reviewed several lines of environmental thinking and policy strategies. Although containing specifically planned activities, these plans are not binding for the EU members' actions (European Environmental Bureau 2005).

The first EAP from November 1973 had underlined the importance of "sustainable development". Yet, the main motive for the first environmental legislation was not only the ecological concerns. Different national standards for vehicle emissions and the amount of lead content in petrol could hinder creation of common market. On the other hand, there was a growing awareness about air pollution, and its global scope since it could not be contained within each member state's territories.

Notwithstanding this, the first EAP contained "down to earth" initiative. However, it soon became clear that a more qualitative approach was necessary. Thus, the 2th EAP followed the first one in terms of approach and objectives that included more issues related to protection of nature. As this EPA occurred during the economic recession, its measures were relatively weak.

The 3th EAP shifted its policy approach as a consequence of some specific developments. Following the national clean-air policy aiming to reduce the large combustion plans and cars emissions, the German special interest organisation has strongly supported the European harmonisation of

environmental control policy considering this measure an essential component enhancing the European industry competitiveness in global markets.

At the end of the 80s, the 20th century green parties achieved political presence at national and the European Parliament levels. Also considerable numbers of Environmental Citizen's Organizations were set up, voicing the environmental concerns. Thus the 4th EAP (1987-1992) proposed 1) environmental protection as an integrated part of economic decision-making; 2) discussed sectorial approach analysing impacts of strategic economic sectors, and 3) introduced new instruments such as taxes, subsidies or tradable permits. During this EAP, the EC proposed to stabilise emissions by a mix of efficiency improvements, fiscal instruments and research and replace the end-of-pipe solutions by regulations and command-and-control approaches.

The 5th EAP which coincided with economic crisis and difficulties with ratifying the Maastricht Treaty, the governments and special interests organisations expressed doubts as to whether they want to the "paradigmatic change" from the previous EAP where a change from "trade orientation" to a "sustainable frame" was adopted. This reaction came particularly from those who would have to bear the costs resulting from the above changes.

At the end of the 5th EAP period, the initial sustainability approach enjoyed a certain revival with new legislation and work programmes proposing to include sustainable development into environmental policy. This new approach, which involved important players into the EC policy preparation, allowed the industry interests to influence the policy work at all Commission levels.

The 6th EAP adopted a more cautious procedure. It postponed the most polemical political decisions to the latest preparation phases and avoided external participation in environmental policy making. The 6th EAP was important for keeping environment on the EU agenda, but its implementation was judged as un-ambitious, and partly a failure. The 7th EAP is still under discussion, despite the fact that it should have been introduced already in 2012.

5.1.1 Formal legislation

The **Kyoto Protocol** was adopted, on 11 December 1997 and follows the main principle agreed in the original 1992 **UN Framework Convention** that imposed stabilization of atmospheric concentrations of GHG gases at levels hindering the dangerous anthropogenic interference with climate system.

According to the Kyoto Protocol, the Contracting Parties from developed countries were committed to reduce their combined greenhouse gas emissions by 8% as compared to 1990s levels over the period from 2008 to 2012. Beyond the industrial gases limits established under the 1987 **Montreal Protocol on Substances that Deplete the Ozone Layer**, the Protocol has also imposed the limits on emissions of six greenhouse gases: carbon dioxide (CO2); methane (CH4); nitrous oxide (N2O); hydro-fluorocarbons (HFCs); perfluorocarbons (PFCs) and sulphur hexafluoride (SF6).
In 1999, as a part of the overall Community strategy (Kyoto Conference) a **Directive (1999/94/EC)** was passed to ensure that information on fuel economy and CO2 emissions produced by new passenger cars was used to influence consumer choices in favour of cars which used less fuel and

emitted less CO2, and, to encourage manufacturers to reduce fuel consumption by new cars.

Although being ratified in 2002 by the EU, and two years later by Russia and entering into force in 2005, the Kyoto Protocol wasn't ratified by large industrialised countries such as the United States and Australia.

In 2003, a **Directive (2003/87/EC)** established a scheme for trading the GHG emission allowances in a cost-effective way to reduce industrial pollution without government interventions and also, to meet the EU commitments to Kyoto Protocol. EU ETS was the first, and is still by far the biggest international system for trading GHG emission allowances, covering more than 11,000 power stations, industrial plants and airlines in 31 countries (EU-27 plus the three EEA-EFTA states (Iceland, Liechtenstein and Norway) and Croatia). In this scheme, a cap is set on the total amount of GHG that can be emitted by all the participating companies. This cap is distributed among the Member States according to their share of verified emissions from the EU ETS installations in 2005. The allocation of ETS is based in several parameters that on the one hand encourages emission reduction but on the other intends to minimise competition from players who face lower environmental obligations and costs (carbon leakage). Depending on the sectors and its position on an internal benchmark, each company receives a percentage of needed ETS for free, progressively reducing year by year. The remaining ones have to be auctioned or purchased from other players, while the surplus credits can be sold. From 2012 onward, the EU ETS includes aviation **(Directive 2008/101/EC)**, so that the fast-growing emissions from this sector are put in line with the EU environmental obligations. This measure has been temporarily suspended by the EC for all flights arriving at and departing from the Community as a gesture of good will to encourage International Civil Aviation Organization[56] (ICAO) to complete a global agreement on emission reduction, and avoid multiple regulations affecting non-European airlines. The Directive continues to apply in full to flights within the EU. Directive 2009/29/EC amended EU ETS Directive (2003/87/EC) by introducing the shipping industry's emissions on EU ETS scheme. It will enter into force in 2013, if no international agreement will be reached by the International Maritime Organization (IMO). In parallel with aviation industry, the EC is delaying this legislation, and considering other options than EU ETS.

The end-of-life vehicle scraping generates annually around 8 to 9 million tonnes of waste in all MS. The **End-of-Life Vehicles Directive (2000/53/EC)** aimed to minimise the waste from end-of-life vehicles by making vehicle dismantling and recycling more environmentally friendly, and by pushing manufacturers to produce recyclable vehicles. It has set quantified targets for reuse, recycling and recovery of vehicles and their components, and reduction of hazardous substances.

The **Environmental Noise Directive (2002/49/EC)** is to "define a common approach intended to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to the exposure to environmental noise". As transportation is a major source of noise-pollution in

[56] „A specialized agency of the United Nations, the *International Civil Aviation Organization (ICAO)* was created in 1944 to promote the safe and orderly development of international civil aviation throughout the world. It sets standards and regulations necessary for aviation safety, security, efficiency and regularity, as well as for aviation environmental protection. The Organization serves as the forum for cooperation in all fields of civil aviation among its 191 Member States", in http://www.icao.int/about-icao/Pages/default.aspx

particular road and rail vehicles and infrastructure and aircrafts, this directive has set four principles (monitoring the environmental problems, informing and consulting the public, addressing local noise issues and developing a long-term EU strategy). It implementation is however, left to the discretion of competent authorities.

In order to curb the impacts that aviation has on global climate change, which according to some research exceed twice the impacts of carbon dioxide alone, and also taking into account that the noise pollution has considerably increased over the last years, a **Directive (2002/30/EC)** was launched in 2002. Its objective was to control the noise levels in areas around airports by establishing identical rules for all airports and avoiding unfair competition. Five years later, a **Regulation (EC) No 71/2007 "Clean Sky Joint Technology Initiative"** was published to encourage development of new technologies for clean, innovative and competitive air transport system through private/public research partnerships.

The necessity of a more precise and more frequent evaluation of reducing the emissions has underpinned the **Decision No 280/2004/EC** which established a new mechanism for monitoring and reporting greenhouse gas emissions. This Decision is now revised in order to propose improvements based on experience from its implementation.

The **Directive 2005/35/CE** was launched in 2005 was to improve the maritime safety and protection of marine environment from ships' pollution through introduction of penalties, including the criminal ones for pollution offences. This Directive was amended in 2009 by **Directive 2009/123/EC**.

To address the persistent growth of road transport, **Directive 92/106/EEC** announced needs for combined transport integrating rail, inland waterway and sea transport to reduce demand for road carriage. This directive allows member states reduce or refund the motor vehicle taxes applicable to road vehicles routed in combined transport, and by so doing improve intermodality.

To stimulate market for clean and energy-efficient road transport vehicles, **Directive 2009/33/EC** was launched two years later. It aimed at standardising the large-scale production of passenger cars, buses, coaches and trucks and also promoting exchange of knowledge and best practices for enhancing purchase, thus stimulating demand for these vehicles. The attainment of climate objectives was to be facilitated by more energy efficient motor vehicles and moving more cargo by intermodal chains.

As a result, during the **March 2007** meeting, the **European Council** made a unilateral commitment to reduce by 20% gas emissions as compared to 1990 levels of the overall greenhouse released by its 27 members, or by 30% if the other major economies apply their fair share of global emissions reduction. The **Decision No 406/2009/EC** was passed to reinforce the commitment and to transform Europe into an energy-efficient and low greenhouse-gas-emitting economy.

In 2010 the Council **Decision (2010/631/EC)** introduced the Barcelona Convention for the protection of the Mediterranean Sea and Mediterranean countries. Nowadays the Convention

comprises 22 contracting parties. The Barcelona Convention and the Mediterranean Action Plan aims to prevent and abate pollution from ships (and aircrafts) in the Mediterranean Sea. Its protocols that affect directly transportation activities are 1) Protocol for the prevention of pollution of the Mediterranean Sea by dumping from ships and aircraft, that defines whose dumping are prohibited, and whose are allowed after an assessment of the competent national authorities, and 2) Protocol concerning cooperation in preventing pollution from ships and, in cases of emergency, combating pollution of the Mediterranean Sea.

5.1.2 Informal legislation, research and joint initiatives

In 2001, almost ten years after the first White Paper on common transport policy was published, the next **White Paper** entitled "European transport policy for 2010: time to decide" was issued. It was to transform the European transport system into more environmentally sustainable by rebalancing the usage of different transport modes, revitalising railways, promoting inland waterways and sea transport, and controlling the growth in air transport. In 2005, a mid-term review evaluated the targets achieved and proposed adjustments. Four years later, when the 2001 White Paper's ten year validity period was coming to an end, the European Commission adopted **Communication on the Future of Transport** where results from scientific studies, discussions with focus groups and stakeholders were compiled to identify policy options which could be tested and included into the 2011 White Paper. Two years later, the **White paper** "Roadmap to a Single European Transport Area" was launched with an objective to build a competitive transport system that will increase mobility, remove barriers in key operations areas, reduce fuel consumption and foster employment. The latter would dramatically reduce Europe's dependence on imported oil and carbon emissions from transport until 2050.

In 2006, in line with the 2001 White Paper that emphasised development of intermodality the **Marco Polo Programme** was established (Regulation (EC) No 1382/2003). Marco Polo I programme intended to improve intermodality, reduce road congestion and negative externalities of freight transport by shifting large cargo volumes from roads to more environmentally friendly transport modes. The Marco Polo II programme launched in the same year pursued the same objectives but had larger budgets and supported new types of activities in areas that included neighbouring non-EU countries.

In 2007, the **AIRE (Atlantic Interoperability Initiative to Reduce Emissions) Programme** was started. It comprised a partnership between the European Commission, the Federal Aviation Administration (FAA) and a number of European and North American participants. Its main objective was to analyse the aircraft technologies and improve the operational procedures which had direct impacts on greenhouse gas emissions in short-and medium terms. This programme had a high acceptance and most of the solutions validated are already in operation or will be adopted in the short time.

In the same year, a **"Strategy on climate change for 2020 and beyond" (COM (2007) 2 final)** was published. This Communication followed the 2005 Communication "Winning the Battle against Global Climate Change", and sought to devise more specific steps to mitigate the effects of climate change and support the EU in achieving a 30 % reduction in greenhouse gas emissions.

After the Green Paper on more sustainable ship dismantling was adopted in May 2007, the EC issued in 2008 a new Communication **(COM (2008) 767) on a strategy for better ship dismantling practices.** It sought to reduce the negative impacts of ship breaking, and ensure that the EU ships are disassembled at safe and environmentally sound facilities worldwide.

In 2008 the EU green gases emissions fell below the 1990 levels due to economic crisis. Also the rise in oil prices lowered the energy consumption causing that many emission allowances were not used during the recession period, and were thus carried forward into the future. However, as a result of sovereign debt and the euro instability crises, the emission prices kept dropping, also cutting the costs of 20% of emission reduction target. Yet, this rate of reduction cannot be simply extrapolated beyond the economic crisis which constrained the industry investment capacity. In addition, uncertainty as to how the national insolvency and the euro crises will be resolved and how long it may take to recover have both amplified the risks of attaining the 20% reduction target.

Thus it became essential to assess the costs and the benefits that each EU member may acquire from moving beyond the 20% emission reduction. In 2010 a **Communication (COM(2010) 265 final)** was launched which set out to establish how these developments impacted on attainment of 2008 targets, and what effects a policy of reducing the greenhouse gas emissions by 30% would have had. In addition, the Communication has warned that taking into account the costs associated with achieving the 20 % emission reduction, further compression of emissions by 30% would cost € 81 billion, which was €11 billion more than the initial cost estimates for the "climate-energy" package showed.

As a framework for several legislation, the EC **Communication COM (2008) 435** sought to define a better strategy for internalisation of external costs of transport industry, as part of a package of initiatives intending to make transport sector more sustainable. The different modes have their respective recommendations by the actual or envisaged legislations.

The **Action Plan on Urban Mobility Communication (COM (2009) 490)** launched in 2009 proposed an array of short and medium-term actions until 2012 for gradual dealing with urban mobility issues. In fact, urban areas - which in 2007 contained more than 72% of the European population, have confronted the needs for transforming the city transport into environmentally sustainable and competitive by addressing the growing socio-environmental concerns. Hence, the urban transport grids should provide multiple interconnection points and efficient "last mile" freight and passenger transfer.

In 2010, the EC acknowledged the importance of environmental information, the needs for understanding how the world is changing and what role the citizens play in this transformation. This came to the fore through publication of the **COM (2005) 565** which put the foundation for development of **European Earth monitoring programme GMES (Global Monitoring for Environment and Security).** In 2011 **t**his programme has established the European Earth Observation which carries out monitoring of the Earth sub-systems and collects up-to-date information on how the planet's climate is changing and how to improve the world citizens'

security. The main users of GMES programme, also known as the Copernicus' Programme are policymakers and public authorities who rely on these data for development of environmental legislation and policies, and for taking critical decisions.

In line with the Environmental Noise Directive, the Commission released in 2008 the **Communication (COM (2008) 432)** concerning the rail noise abatement from freight trains of the existing fleet without jeopardising competitiveness of rail freight mainly by retrofitting the freight wagons with low-noise brakes as the most cost-effective measure.

New legislation on the sound level of motor vehicles was launched by the EC **(COM(2011) 856)**, to reduce the negative impacts of noise exposure of European citizens caused by motor vehicle traffic by around 25% and to safeguard internal market for motor vehicles good functioning of the entire internal market while also protecting the societal and environmental health. To silent the electric and hybrid vehicles moving at low speed, this legislation proposed minimum sound levels for warning of pedestrians and other vulnerable users.

In addition to the above mention formal and informal policies, it is clear that those legislation and initiatives reviewed under the previous chapter on transport policy that scope increasing transport's efficiency and capacity may also enhance environmental policy objectives since a better use of infrastructure and vehicle capacity requires fewer fuel and energy consumption.

5.2 Impacts on transportation industry by sector

Assessing the impacts of environmental policy on European transport industry was constrained by the fact that the studies available focus often on broader implementation effects from the perspective of involved stakeholder, usually the industry or the legislator.

This sub-chapter is organised by transport mode, but since some legislation influences the entire sector, the paragraphs below address the generic topics while each transport mode sub-chapters discuss the more specific impacts.

The transport white-papers provide strategic guidelines for the formal regulations and informal policy actions. The 2011 White-Paper's "Roadmap to a single European transport area – Towards a competitive and resource-efficient transport system" deals with environmental concerns in most of its 10 goals such as needs for direct emissions reduction and encouragement of modal shift to more environmentally sustainable passengers and freight mobility as resisting the growth of passenger and freight mobility is not an option. Thus, the environmental impacts of transport activity need to be reduced by a wide range of solutions often related to other subjects as energy and resource-efficiency (see also chapter on energy policy) and infrastructure development (see also chapter on transport policy). Issues like more sustainable travel behaviours, optimised multimodal logistic chains, cleaner vehicles technologies, better information and traffic management technologies and better external costs internalisation in the price paid by the users will be addressed for each mode in the subsequent sub-chapters. Since infrastructure development and life cycles of trains, planes and ships last for decades and stakeholders such as EU, Member States, regions, cities, industry and citizens need time to change their behaviours, most of the goals drawn by the White Paper have

2030 to 2050 time perspectives.

From an environmental perspective the **trans-European transport network (TEN-T)** has also been an important instrument because it has ensured a more sustainable mobility of people and goods by means of promoting passenger modal shift from road to rail and from airplane to high speed rail, which can definitely generate the emissions reduction outcome (for CO_2, NOx and particulates), Yet, the bottleneck removal on road axes it is not that easy to evaluate as regards environmental consequences. It can have a positive impact if it shortens travel distance or reduction of congestion, but those positive effects can be jeopardised by modal shifts from rail to road or by increase in second-order derived traffic. Another example is the modal shift from road to inland waterways or railways with diesel locomotives. Emission reduction impacts of these modes are closely related to the age of the fleet and adoption of technology improvements, since road engines emit on average fewer pollutants (ECORYS 2007).

Air pollution and climate change play an important role in environmental legislation. The EU Strategy on climate change for 2020 and beyond (COM (2007) 2) identifies options for "*realistic and effective*" measures in the EU and globally to allow the Kyoto objective to be met, including the transport sector. An impact assessment referred by the EC says that the "*investment in a low-carbon economy will require around 0.5 % of total global GDP over the period 2013–2030. This would reduce global GDP growth by only 0.19 % per year up to 2030, a fraction of the expected annual GDP growth rate of 2.8 %. This is an insurance premium to pay, and would significantly reduce the risk of irreversible damages resulting from climate change*".

Despite EC legislative efforts and vehicles efficiency improvement, transport demand increase has raised the GHG emissions by 36% since 1990. Road sector accounts for 2/3 of the total emissions value, but emissions from aviation and international shipping are also growing due to significant demand increase. With these figures, it is clear that reduction of the GHG emission by 20% till 2020 compared to 1990 levels or even further by 30% (Decision 406/2009/EC, aligned with (COM (2007) 2)) will not be facilitated by transport sector alone. Between 2008 and 2009 the road transport GHG emissions fell by 2.7%, but this effect was due to the economic recession. There was also a decrease of emissions from the international shipping and aviation (10% and 7%, respectively) mainly due to the economic crisis. These two sectors represent 6.3% of EU-27 GHG emissions, but are not included in Kyoto targets (EC 2011/C624). The EC has a range of policies (detailed below for each of the three modes), aligned with the White Paper, aiming to reduce these effects that comprise 1) inclusion of aviation and international shipping in the EU ETS; 2) motivating public procurement authorities to take into account and monetise the life time energy use and CO_2 emissions when purchasing goods and/or services for public consumption, 3) reducing emissions from cars and vansby means of setting up binding emissions targets for new vehicles and 4) reduce the greenhouse gas intensity of fuels.

Furthermore, the EC considers in Communication (2010) 265 reducing GHG emissions by 30% in 2020 as compared to 1990, if the other major economies agree to accept their fair share. The Communication also seeks to facilitate a more informed debate among stakeholders on economic repercussion of the 20% and 30% targets for emission reduction. The main reason is that all

countries will need to commit themselves voluntarily to more efforts if the 80-95% reduction in 2050 is to be reached. But the EU efforts alone are not enough and even the countries that ratified the Kyoto protocol account for only around 15% of the global GHG emissions. On top of that the last COP18 showed no real efforts from the non-parties to strengthen their commitments to reduce GHG emissions, in some part justified by the current economic crisis. The Communication concludes that a 30% commitment should stay open, but that the international context is not favourable.

The Kyoto protocol compliance has been monitored and reported by the **Monitoring Mechanism** Decision No 280/2004/EC. This process has been challenged by the newest legislation, proposing to revise these mechanisms. Decision 406/2009/EC (to reduce GHG by 20% in 2020) and Directive 2003/87/EC (EU ETS) introduced shorter time frames for the annual compliance cycle and for annual EU review of MS GHG inventories and reporting on auctioning revenues. Also the emissions from international shipping industry and aviation need to be added to inventory reports. Results from the DG CLIMA service contract, (Herold, et al. 2011) concluded that "*The experience gained through the implementation of the Kyoto Protocol and the various UNFCCC requirements has shown that the current monitoring and reporting system, although it has many merits, needs to be improved as it is not always fully effective*".

The **European Earth observation programme Copernicus** is an 'Earth observation' system that provides information on the state of environment collected by satellites and the ground, airborne and seaborne stations. It can monitor the GHG and climate changes through regular monitoring of atmosphere, oceans and continental surfaces. This system can also be used not only by policy makers for development of new legislation, but also by public authorities measuring pollution from road traffic and following up the entire transport sector. It can also support the ship routing services and accidents prevention, providing information of both currents and sea ice. Copernicus services should be fully operational by 2014; the downstream value-added services will be deployed along with the Copernicus platform and brought to the market through a viable business plan. The (SPACE TEC Partners 2012) foresights that Copernicus will generate around 85,000 new jobs over 2015-2030 in the downstream and upstream R&D and services and that the societal benefits may exceed four to twelve times its cost.

In the urban realm, there are also several initiatives that contribute indirectly to more environmental sustainable transport and thus to achievement of the 20-20-20 objective[57] to combat the climate change. Urban mobility is by nature of regional or national scope, but the European approach can boost the local actions, which can also have regional impacts, and contribute to diffusion of best practices. The EC 2009 **Action Plan on Urban Mobility** (COM(2009) 490) increased the scope of actions improving urban sustainable mobility (urban freight, travel information, clean and energy-efficiency vehicles, internalisation of external costs, pricing schemes, Intelligent Transport Systems, among others) and raised awareness of available funding from the Structural and Cohesion funds and the European Investment Bank for development of sustainable urban mobility plans and regional policies (DG Mobility and Transport 2012).

[57] 20% reduction in emissions, 20% renewable energies and 20% improvement in energy efficiency by 2020

Noise is one of the side effects of transportation. **Noise pollution** is addressed by EU legislation represented by an overarching Environmental Noise Directive (2002/49/EC) and several specific ones for road, rail and aviation. This policy mix contains measures such as market access requirements, railway interoperability specifications and rules on airports operations restrictions. Most of the noise pollution impact assessments have an ex-ante character and it is more related with health and social impacts on populations. The World Health Organization's (WHO) Night Noise Guidelines for Europe recommend that the annual average night exposure should not exceed 40 decibel (dB) outdoor. Above this value, sleep disturbance and insomnia may occur. One in five Europeans is exposed to sound exceeding 55dB on average at night, which can trigger elevated blood pressure and heart attacks. The types of transportation activities are important for the maximum level of noise parameters produced by lorry, aeroplane or train (WHO 2007). European Commission recently estimated that noise pollution from road and rail traffic across the MS has a social cost of about €40 billion each year (0.4% of total EU GDP, including health care costs) (European Comission 2011). There is no evidence as to how these measures impact on European industry competitiveness, since priority was given to noise emission standardisation in line with the common market's objectives (EC 2012 h). The different measures prescribed by the Directive are still under implementation by the MS and several delays have been observed. A comprehensive and realistic impact assessment can only be obtained after a second round of noise mapping (EC 2011/C321) has been completed. However, the noise reduction instruments have already boosted new research and innovation areas from which more silent transport equipment may be launched.

The (Directive (2000/53/EC)) dealing with the **waste** generated by transport industry such as the end-of-live vehicles and ships dismantle (Com (2012) 118 final) used the "polluter pays principle[58]" and "extended producer responsibility[59]" approaches as a basis for formulation of an overarching EU Waste Framework Directive and the relevant international laws and agreements.

Although not new for the EC, the **Internalisation of external costs** caused by transport is still not an easy to achieve. Communication (2008) 435 proposed market-based measures as an overarching strategy for internalization of all modes' external costs. The main actions proposed were 1) amending Directive 1999/62/EC to allow charges for external costs of haulage sector; 2) use The Urban Mobility Action Plan to encourage more sustainable car usage; 3) address noise pollution by rail transport; 4) include air pollution and climate change in maritime transport (through international agreement with IMO or EU ETS); and 5) impose noise pollution, air pollution and climate charges (EU ETS) on air transport. It states also that the revenue generated by internalisation should be channelled to making transport more sustainable, funding research and

[58] OECD defines the polluter-pays principle as „the principle according to which the polluter should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level (standard) of pollution", in http://stats.oecd.org/glossary/detail.asp?ID=2074

[59] OECD defines EPR as „an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. An EPR policy is characterised by: (1) the shifting of responsibility (physically and/or economically; fully or partially) upstream toward the producer and away from municipalities; and (2) the provision of incentives to producers to take into account environmental considerations when designing their products. While other policy instruments tend to target a single point in the chain, EPR seeks to integrate signals related to the environmental characteristics of products and production processes throughout the product chain", in http://www.oecd.org/env/tools-evaluation/extendedproducerresponsibility.htm

innovation, and invest in more environmentally friendly infrastructure, public transport, and development of TEN-T. According to the Communication, the Commission will carry out an evaluation of these measures in 2013.

In the **intermodality** area, the Marco Polo co-funding programmes I & II were launched in 2006 to help the companies to shift freight from roads to greener modes - railways, sea-routes and inland waterways. The impacts assessed for the already completed Marco Polo Programme I indicated that only 46% of the modal shift goals was achieved, and that totally 21.9 billion tonne-kilometres freight was removed from European roads. But it was also established that the allocated budget has not been entirely spent, since the programme is based on quantifiable results and funds were released in response to the actual modal shift realised. Since the intermodal transport solutions are more complex and expensive, the economic crisis has also reduced these results. Moreover, the programmes are considered complex and not easy to be used by European companies (EC 2013/C278). Marco Polo helps also financially transport operators, who otherwise would not be able to bear the initial losses to develop and deliver environmentally responsible transportation services (ESC 2012). However, critics of these schemes maintain that financial support offered to private startups and/or national operators who develop new environmentally responsible lines of service may harm these companies' long-term competitiveness because it might prevent the industry to devise more innovative solutions that reduce the costs of service initiation.

Directive 92/106/EEC allows the MS to promote **cross-border intermodality of freight transport** by reducing or reimbursing taxes on motor vehicles in intermodal freight movement. For that, only the first or final leg of the freight transport can use road, while rail, inland waterway or maritime service over distances exceeding 100 km should be used on the remaining ones. The impacts of this Directive cannot be easily assessed because of insufficient reporting from market monitoring. However some faults have already been pointed out such as e ambiguity or lack of definitions of transport modes used and fiscal incentives. The EC is now in a tendering process for a project assessing impacts of this Directive.

5.2.1 Rail

Direct impacts

The **2011 Transport White Paper** states clear goals to increase the share of railways in carriage of passengers and freight over the next decades. It has an indirect implication for environment, since rail is more energy efficient and more environmentally benign as regards CO_2, air pollution and noise. The main goals are defined following three main lines of action, a) infrastructure development, b) national and cross-border interoperability improvement and c) promotion of stakeholders' behavioural change towards more sustainable transport modes. These goals include 1) speed up infrastructure development (triple the length of the existing high-speed rail network by 2030 and maintain a dense railway network in all MS); 2) complete a European high-speed rail network by 2050; 3) achieve a fully functional and EU-wide multimodal TEN-T 'core network' by 2030, with a high-quality and capacity network by 2050; 4) improve national and cross-border interoperability by connecting all core airports to the rail network, preferably through high-speed rail by 2050; 5) ensure that all core seaports are sufficiently connected to rail freight and, where

possible, to inland waterway system; 6) compete deployment of transport management systems - ERTMS; 7) shift 30% of road freight over 300 km to rail or waterborne transport by 2030, and over 50 % by 2050; 8) secure that the majority of medium-distance passenger transport happens on railways by 2050; and 9) move towards full application of 'user pays' and 'polluter pays' principles to curb pollution.

Noise pollution is the most negative environmental externality of rail. The EC noise regulation known as Technical Specifications for Interoperability (TSI) (EC/16/2001) covers high speed and conventional rail while COM (2008) 432 was adopted to reduce noise from the existing rail fleet. The principal noise font is rail-wheel interaction that is more severe for freight wagons, often operated at night. The rolling stock has a long lifetime and noise has a logarithmic nature. Thus, to cost-effectively reduce the citizens' exposure to rail noise and not to jeopardise competitiveness of rail freight, the Working Group Railway Noise of the European Commission recommended measures reducing noise at source (vehicles and tracks) and retrofitting wagons with low-noise brakes. The targets are freight trains representing around 85% of the fleet and 97% of the overall transport performance with an annual mileage of more than 10,000 km and life expectancy of at least five years (EC 2008/C432). On the other hand, noise barriers are another abatement measure, particularly used in dense urban areas. According to a report from the International Union of Railways (UIC) and the Community of European Railway (CER) €150 - €200 million are spent yearly in Europe on noise barriers and installing insulating windows. By channelling only a portion of this amount to retrofitting wagons the same amount of noise would be reduced and money would be saved (UIC / CER 2007). The same report states that fitting new wagons with low-noise break blocks is cost-neutral. Railways have been using this technology since 2002 on new rolling stock. Up to 2007 more than 8,500 of such silent wagons were either already in operation or had been ordered.

Assessment of impacts of noise abatement legislation is not consistent. Because the effects are expected to materialise in medium- to long terms, there is still long before all these noise reducing measures are fully implemented. The main obstacle to large scale retrofitting is a financial one. However, there are at least 3 reasons for intensifying the noise abatement measures. First, citizens demand considerable rail noise reduction and ask for relevant political initiatives. Second, the competitiveness of the rail industry can be improved by introduction of uniform noise limits for all MS and by incentivising the industry to innovate the noise reducing gadgets for better positioning within the EU and external markets. However, since retrofitting of railway infrastructure and rolling stock resulted from political decisions taken by national companies these developments distorted the intra-rail EU competition. 3) The increase in railway operation costs due to retrofitting measures may spur market loss by rail companies and increase road transport externalities (PricewaterhouseCoopers Advisory 2007).

Research impact and industrial outcomes

Several research projects have been initiated to answer the EU Environmental Noise Directive 2002/49/EC (END) to questions as to whether railways or road are the main contributors to noise pollution. Two of these are:

- ENNAH (2009-2011), the European Network on Noise and Health was funded by the European Commission (DG for Research and Innovation), to establish a European research network of experts on noise and health and to base future noise legislation on empirical evidence. This network brings together 33 European research centres working on environmental noise sources, including transport, with an aim to assess the knowledge status and identify topics for future research.
- The Joint Research Centre, Institute for Health and Consumer Protection (JRC-IHCP) run several research projects aiming at providing technical support for implementation of the END and harmonisation of noise assessment methods. CNOSSOS-EU is a project coordinated by the JRC-IHCP that will during 2012-2015 put in place all noise reducing measures already in use to help the next round of EU-wide strategic noise mapping exercise foreseen for 2017. Three reports have already been released: 1) in 2008, an IHCP Noise mapping report, "Assessment of the equivalency of the national noise mapping methods against the interim methods"; 2) in 2011, a joint WHO-JRC report, "Burden of disease from environmental noise. Quantification of health life years lost in Europe"; and 3) in 2012, a JRC report, "Common noise assessment methods in Europe (CNOSSOS-EU). These noise related research activities pertain to several modes.

Further areas of environmental concerns include harmful emissions from diesel locomotives, design for easy recycling and reducing the amount of hazardous materials used in construction processes.

Some FP7 projects addressing these subjects include

- HOSANNA - **Holistic and sustainable abatement of noise by optimized combinations of natural and artificial means (2009-2013) - will** optimise the usage of green areas, green surfaces and other natural elements in combination with artificial measures to reduce the noise levels and noise impacts on urban and rural environments.
- QUIESST - **Quietening the environment for a sustainable surface transport (2009-2012) -** QUIESST concerns the surface transport noise abatement needs (road and rail). It considers the cost benefit outcomes of the END objectives, and proposes the wave propagation and systems for passive compensation as holistic noise abatement solutions. Its team, made of 14 partners from 9 countries also integrates infrastructure providers, industry sectors, universities, research institutes and SME. The final verifiable result will be the Guidebook to NRD optimisation as a reference tool for noise mitigation.
- RIVAS - **Railway Induced Vibration Abatement Solutions (2011-2013) -** Ground vibration, generated by rail traffic, is an important environmental concern because it affects European citizens located in the vicinity of rail infrastructure. A group of railway operators, infrastructure managers, infrastructure and rolling stock manufacturers, construction companies, and end users of vibration mitigation technology, have congregated to create new tools and methods to reduce vibration below the threshold of perception while the induced noise below background.

- CleanER-D - Clean European Rail-Diesel - aims to develop and integrate emissions reduction technologies for diesel locomotives and rail vehicles. It will also use innovative methods and hybrid solutions for the largest possible reductions of CO2 emissions.

All railway stakeholders recognize that noise is a health problem. Since 1998, the International Union of Railways (UIC), the Community of European Railways and Infrastructure Companies (CER) and the International Union of Private Wagon Owners (UIP) have been working on an "Action Programme for Noise Abatement in Freight Traffic". The noise reduction at the source has been the main target there and two types of new technology for rail wagon brakes were developed. The main noise font is the cast iron brake shoe on the rough wheel surface, so these brakes have been replaced by synthetic ones with effective noise abatement of up to 10dB (representing the 50% reduction imposed by legislation). Installed on new wagons are the so called k-blocks, which are made of organic composite material and whose implementation is cost-neutral. Against this background, the retrofitting adjustments to the braking system can cost €10,000 per wagon. Thus, there is the so called LL-blocks technology, made of either organic composite material or sinter metal, designed similarly to the cast iron breaking systems. The LL-blocks present the same noise reduction of up to 10dB. The brake blocks are homologated by the International Union of Railways (UIC), in the absence of relevant European technical specifications. The homologation consists in a set of tests concerning braking, safety and operational performance. K-blocks have already been homologated, and LL-blocks have successfully passed a 2 year test and 200,000 km of runs, with almost 30 railways companies and several industry partners. Final report will be published soon by UIC (UIC 2013).

Another technological development and deployment and industrial progress with environmental impacts is the European Rail Traffic Management System (ERTMS). Although rail has been appointed as the most sustainable transport mode, there are several barriers that reduce its cross-border interoperability, such as different gauges, electrification systems, administrative procedures, operational rules, train certification or more than 20 signalling systems in Europe. ERTMS represent a unique signalling system for Europe, and besides the competitiveness benefits that were reported in the former chapter, this system has the ability to reduce the headway between trains enabling up to 40% more capacity on currently existing infrastructure (UNIFE 2012). These significant capacity and performance benefits on overall railway operation has the potential to reduce greenhouse gas emissions by facilitating the increase of rail mode share, thus balancing transport, environmental and competitiveness policies.

5.2.2 Road

Direct impacts

As road is concerned, the 2011 White Paper had very ambitious goals, mostly related with technology development and deployment that ensure more environmental sustainable vehicles (halve the use of 'conventionally fuelled' cars in urban transport by 2030; phase them out in cities by 2050; achieve essentially CO_2-free city logistics in major urban centres by 2030) and travel behaviour change with the clearer application of 'user pays' and 'polluter pays' principles. On the other hand, there is an explicit will to diminish drastically the road market share compared to rail for passengers and rail and waterborne for freight, since those modes have specific goals of market share increase.

The EC has been releasing legislation to encourage users' behaviour change, towards more environmental sustainable car ownership choices. Directive (1999/94/EC) aim to ensure that European consumers have easy and free access to clear information on fuel economy and CO_2 emissions of new passenger cars offered for sale or lease. This information has to be attached on a label in the vehicle on the sales point, on emissions guides, and in all promotional material. On an impact assessment study made for DG CLIMA comprising 8 Member States, was not possible to conclude if this directive has a positive effect on users or manufactures technological decisions. There is limited evidence that this Directive may have positive impact on raising consumer awareness, since only one study in one MS was conducted in this way. On the other hand, it is possible to measure that CO_2 emissions from new fleet have been declining in the last years, but again it is extremely difficult to conclude that this directive had a determinant role alone, since there is a significant policy mix of initiatives and measures to reduce GHG emissions from new passenger cars (AEA 2011). Besides the Voluntary Agreement on Passenger Car CO_2 emissions and the current regulation on new car CO2 emissions, there is a basket of taxation measures related with vehicle purchase and ownership and purchase subsidies for new passenger car exchange. There are no global impact assessments available to infer the effect of this taxation on consumers' choices for less polluting passenger cars. Among Member States there are significant differences on car taxation on the purchasing moment (from none to high levels) and annual circulation tax and its calculation base. Also other influencing factors vary significantly among MS, such as economic prosperity and expectation of its growth, individual *vs.* company car ownership, access to alternative public transport, consumer attitudes and traditions, among others. (Duer, Rosenhagen e Ritnagel 2011) conducted a research for Nordic countries and concluded that differentiated registration and circulation taxes have a positive effect towards more CO efficient cars, and company own fleets may have larger change potential due to its higher sensibility to legislative framework and society's attitudes. The authors conclude also that better results may be possible to achieve if taxation initiatives are connected with better labelling of cars, including overall annual costs (fuel included), introduction of a green car class for gradually improving energy efficiency and CO_2 reduction and review of Nordic company passenger car subsidy schemes.

As mentioned before, road has the largest market share of all modes, including urban and freight mobility. Besides the white-paper goal to reduce these shares, air-pollution will continue to be an issue if no technological and behavioural changes are introduced. It is unanimous that fuel-price and

its correspondent savings on fleet operational costs are the stronger indirect factor on emissions reductions. But legislation and measures can play their role also. With Directive (2009/33/EC), the EC aimed to introduce the willingness and specific rules for public authorities and private operators with public service contracts to monetise environmental impacts related to energy consumption, CO_2 and other pollutant emissions over the whole lifetime of the vehicle in the purchasing decision of road vehicles. . Besides promoting a behavioural change on contractors, this directive also aims to promote the internalisation of environmental external costs, and, in the long-run, the promotion and deployment of cleaner-vehicles by the manufactures thru more rapid market penetration and consequent possible economies of scale. Its implementation in a number of MS was considerably delayed and there are not yet reporting obligations that could allow an impact assessment. On the side of the procurers and the manufactures there is also no available data. On the other hand, several MS had already green-procurement procedures in their legislation, with effects added to EU legislation, vehicle taxation policies and government incentives schemes (European Comission 2013).

The **End-of-Life Vehicles (ELV) Directive (2000/53/EC)** was an early application of extended producer responsibility principles for sustainable life cycle management of products by the EC. Along with general waste prevention, this directive aims to limit the use of hazardous substances, encourage the design that facilitate the re-use and recycling and develop the integration of recycled materials. Defined also rules for waste collection and treatment and defined quantitative goals for ELV waste re-use and recovery. This European initiative triggered also actions on other geographies such as the USA, Japan and South Korea which include mandatory and voluntary actions to be taken by the producers or importers of vehicles, for at least used tires and batteries. The implementation of this directive on most MS and by car companies experienced several difficulties due to 1) complex administrative requirements; 2) reluctance by some member states to impose additional costs on car makers; 3) export of used vehicles to other countries outside the EU with lower environmental standards; and 4) existence of a parallel market that buy old vehicles and re-sell scrap metal or other valued parts without complying with environmental standards (Fergusson 2006). The two consecutive reports from the EC on the implementation of ELV Directive are clear that significant progress has been made in several Member States on its transposition to national law, but the implementation cannot be considered fully satisfactory since several MS do not have fully operational ELV management systems (EC 2009 c). Notwithstanding, several achievements could be reached as 1) the set up of systems for the collection of end-of-life vehicles and its transfer to authorised treatment facilities; 2) adoption of measures in line with the waste hierarchy in order to promote the reuse of components which are suitable for reuse and the recovery of components which cannot be reused, with a preference for recycling and limitation of the use of hazardous substances; 3) dismantling information provided by the producers for each type of a new vehicle put on the market and the use of the IDIS system (International Dismantling Information System) which is regularly updated.

Road transport is also an important source of **noise pollution**. The first round of noise mapping provided by all MS, according to the Environmental Noise Directive (2002/49/EC) requirements, suggests that within agglomerations 40 million people are exposed to noise above 50 dB from roads at night, and more than 25 million people outside agglomerations (European Comission 2011). The

noise pollution fonts on road are motor vehicles and motorcycles and tyres (when meeting the road) and EU has source-specific noise control legislation, introducing limits on sound levels allowed (Directive 70/157/EEC, Directive 97/24/EC and Directive 2001/43/EC). A low noise road surface is a future possible issue that Commission may be legislating about. Thus, noise is one part of the European Whole Type-Approval tests that each new product series has to be conforming to before entering the market (others include security, safety and other environmental impacts). On the competitiveness side, there is no evidence that this legislation brings significant effects, since international standards have been used before, allowing industry to use the same production lines for the European and third countries markets. Neither there is evidence of positive effects on noise reduction. The EC is preparing new legislation on the sound level of motor vehicles (COM (2011) 856), aiming to reduce traffic noise by around 25%. This legislation proposes also 1) a new sound test method, in line with international standards, since the existing one does not reproduce the traffic conditions in real life and 2) minimum sound levels to silent electric and hybrid vehicles at low speeds for warning of pedestrians and other vulnerable users. The EC states in its impact assessment that the benefits for society of this new regulation will be 20 times higher than the costs the industry will have to incur.

Research impact and industrial outcomes

Road transport and the automotive industry represent an important social and economic added value to Europe, for its market share and contribution to GDP. Its impacts on society and on the environment have been researched widely, concerning policy makers advisory and lobbying, producers and users' behaviour change and development of new European and global standards for products and scientific methodologies.

Concerning air-pollution, energy-efficiency vehicles and travel behaviour change there are also several research and take-up incentives like the CIVITAS Initiative. Civitas Initiative encourages both innovative technology and policy-based strategies. Its goal is the achievement of significant shift in the modal split towards sustainable transport. Since its launch in 2002, around 60 cities worked together in collaborative research and demonstration projects, having received a co-fund by the European Commission of over €300 million. This programme comprises also CIVITAS Forum Network for best practices and experience exchange with almost 200 cities, representing 68 million citizens in 31 countries.

The implementation of several legislations raises the incentive for additional research on new methodologies and standards. Directive (2009/33/EC) could not be applied to heavy duty vehicles because of the lack of common procedures on the measures of its CO2 emissions. In that sense, International Association of Public Transport (UITP) and the European Automobile Manufacturers' Association (ACEA) worked together to agree on how operators and procurers could apply the provisions of the Clean Vehicle Directive in bus tendering. Also under the Clean Vehicle Directive, research conducted by the UNECE to develop a worldwide harmonised engine test cycle for heavy-duty engine exhaust emissions, to help monetise the benefits of more environmental efficient vehicles on purchase decisions (European Comission 2013). Several research projects funded by the EC on common data gathering and assessment methodologies to give a proper answer to the

Environmental Noise Directive have also been conducted. Considerable research efforts have also been devoted to the effect of noise and air-pollution on human health, with special focus on vulnerable groups. Some reference studies are

- RANCH (Road Traffic & Aircraft Noise & Children's Cognition & Health) was a 5th FP7 co-funded project
- HEARTS (Health effects and risks of transport systems) was a FP7 co-funded project (2002 and 2005) coordinated by WHO which aimed to give value added contributions for the EU Air Quality and Noise Directives, among others goals.
- INTARESE (Integrated Assessment of Health Risks of Environmental Stressors in Europe), a FP6 co-funded project which started in 2005, provided methods and tools for the assessment of health risks from environmental stressors such as transport.

The end-of-life vehicles Directive brings new challenges for the industry on re-usage, recycling and dismantling of vehicles. Some research projects are:

- SEES (Sustainable Electrical & Electronic System for the Automotive Sector), a research project co-funded by FP6, aimed the development of prototypes and dismantling / re-cycling processes for a sustainable, clean, cost- and eco-effective automotive electrical and electronic system (EES), and facilitate the achievement of the recycling / recovery targets laid down in the Directive 2000/53/EC on end-of-life vehicles;
- ECODISM (Ecological and Economical Development of Innovative Strategy and Process for Clean Maintenance, Dismantling and Further Recycling of Vehicle Parts) aims at providing car manufacturers and suppliers with the technologies and methodologies to smartly bond and de-bond vehicles, according to EU's strict targets (Directive EC/2000/53) concerning the reuse, recovery and recycling of materials in end-of-life vehicles. more specifically it focuses on the development of reversible adhesives for different types of bonding assembly;
- EcoLanes contributed to development of Sustainable Surface Transport and achieved reductions of 12% in construction times, 40% in energy reductions and 12% in cost reductions through the use of innovative materials, designs and processes. The project also resulted in an innovative concrete that is reinforced with steel fibres and takes advantage of the more than 3.2 million tonnes of waste tyres that are recycled in the EU, being the concrete recyclable by itself. This allows energy savings and shorter times of road construction. Though its impact on the global competitiveness of the road haulage or car manufacturing industries is probable regardless, savings in infrastructure development may release financial resources to support other objectives.

Leaving aside the energy-related industrial outcomes, the main developments with regards environmental driven research have been in noise abatement and traffic management technologies.

New technologies for improved low-noise tyres are being tested by manufactures and there are already many models in the market that meet the noise limits proposed by the Commission. Those which will not pass the limits will probably be replaced by improved tyres, with lower noise

achieved mainly by the means outlined in the SILENCE[60] Project (European experts on tyres and road noise 2008).

(Transport Research Laboratory n.d.) found that despite the costs of meeting these tyre design changes mainly fall on tyre manufactures and are essentially related to discontinuing the production of some current tyre designs that would not meet the proposed noise limits by the European Commission Vehicle Noise directive (70/157/EEC), low noise tyres are being mass produced without difficulty, and are price competitive with non-compliant tyres. Car manufacturers and manufacturers of commercial vehicles have been trying to reduce noise further through quieter tyres because it less expensive than the cost of further changes to engines and transmissions.

Low noise tyres may also imply costs to the consumer due to advanced materials (e.g. carbon black partly replaced by silica in the rubber compound) however it will also result in lower rolling resistance and thus fuel consumption, which means that the total consumer cost may even decrease (Swedish Road and Transport Research Institute 2007).

According to (Swedish Road and Transport Research Institute 2007), a study elaborated by FEHRL for the European Commission proposed a tightening limitation in tyre noise levels according to the different tyre's categories. Taking advantage of the best already available technologies, FEHRL suggested the adoption of winter tyres for all-year use and the reduction of the air/rubber in the tread pattern. The former intends to take advantage of the favourable noise characteristics of the winter tyres using its construction principles in the summer tyres, that is to say, smaller tread elements and softer rubber compounds. In the USA, "all weather" tyre designs have been very popular. In relation to the reduction of air/rubber ratio in the tread pattern - also explored in the SILENCE project - it has been found that "a combination of softer rubber and lower air/rubber ratio may influence tyre/road noise emission on an ISO surface by about 6 dB(A). If, today's common ratio of 30 % is replaced with 20 % this would give a potential noise reduction of 3 dB(A)", without compromising wet braking or aquaplaning performance. Softer rubber compounds result in lower noise emission and are already used in Japan and in USA. However, in Europe, due to the high maximum speeds on certain motorways, these compounds are less acceptable. Incorporating futuristic solutions (Ulf 2006) suggests tyres with porous tread which could lead until a 5dB noise reduction (expected market deployment within 5-8 years), and tyres composite wheels that allow to achieve a noise reduction until 10dB (expected to be on the market earliest within in 10-15 years).

But noise reduction is not only a matter of the tyres being used. Road surfaces influence the generation of noise by tyre/road interaction and the propagation of noise from the vehicle engine and transmission system. There are several techniques of low-noise road available according to different textures of the surfaces, the texture pattern and the degree of porosity of the surface structure. A change to special thin surfaces can reduce noise by 3-6dB(A), however, it is expected that this type of surface will gradually become noisier with time. The use of porous asphalt is estimated to give a noise reduction of 3-5dB(A), but at a substantially higher cost for the surface

[60] SILENCE is a three-year research project co-funded by the European Commission which has developed an integrated methodology for the improved control of surface transport noise in urban areas.

and a reduced lifetime. Besides, the use of porous asphalt is "only recommended for higher speeds (>60km/h), homogenous traffic flow, roads with only few crossings / traffic lights and without sharp bends" (Polis and AVL s.d.). It is speculated that the addition of rubber in both dense and porous surfaces may add 1-2 dB (A) of extra noise reduction (Swedish Road and Transport Research Institute 2007).

According to (European experts on tyres and road noise 2008), quieter road surfaces have already been and are increasingly being applied in many if not most EU MS, as part of extensive and costly noise-reduction programmes. Despite the considerable investment on the part of public authorities because of the higher initial costs and of the reduced acoustic life time comparing to conventional surfaces, these quieter road surfaces have been implemented on a large and increasing scale, without any push by normative requirements. This can be explained by the fact that compared to other noise abatement measures (like barriers, sound proof windows), the costs for low-noise road surfaces remain relatively low (Polis and AVL s.d.).

Experiments with these different types of road surface were carried out in many countries in Europe (Netherlands, Norway, Belgium, France, UK, Germany) and in other parts of the world (Hong Kong, USA) showing that, despite the greatest reductions obtained, the related effects are only valid locally (while the measures related with tyres and vehicles are effective anywhere). Thus, it is important to apply all available measures in order to achieve the greatest noise reduction as stated by the (Swedish Road and Transport Research Institute 2007): *"... a measure with a higher noise reduction in dB but with benefit to a relatively small number of people might be less justified than a measure with a lower noise reduction but benefiting to all people in the community"*. From a global competitiveness perspective research effects on low-noise tyres might be more relevant for the car and commercial vehicle manufacturing industries, enabling them to export solutions to other world regions (provided they showed similar environmental and health concerns). But for the road haulage (and indirectly for railways and IWW as direct competitors on medium distances), research on both "silent" road infrastructure and tyres is relevant, especially with regards the possible energy consumption reduction that such innovative solutions may bring alone.

In relation to **traffic management**, most toll roads operators use new technology (such as electronic transponders connected to a prepaid account and high-speed cameras that provide digital data) that eliminates delays and ensures the free flow of traffic by avoiding slowing down to pay, and contribute to that vehicles move at more fuel efficient speeds increasing fuel economy, reducing traffic congestion and the extra GHG emissions. Besides, more sophisticated tools applications have been developed and applied in order to reduce pollution and congestion, helping on the internalisation of external costs for the use of a roadway:

- **High-Occupancy Toll (HOT) Lanes** incentive the drivers to carpool because users in high occupancy vehicles (HOV) have specific free lanes to drive while single-occupant vehicles need to pay a toll to use such lanes. This system has being applied, but the opinions about the results have not been unanimous. For London one recent analysis (Jaffe 2011) questioned whether or not traffic had been reduced, and wondered if improving the bus system alone would have been more cost-effective. In Stockholm's adoption of the

programme has been a success: “congestion has plunged without rebounding, sales have grown for exempt fuel-efficient vehicles and both public and political opinion has pivoted from cynical to strong” (US Government Accountability Office 2012). And, although American cities are years away from adopting congestion pricing programs on downtown streets (US Government Accountability Office 2012), HOT Lanes projects seem to be gaining popularity - there are about 400 miles of priced highway lanes in operation, with 11 HOT lanes under construction.

- Within the **Value Pricing Program (VPP)** tolls are charged based on congestion. In simpler systems, toll rates increase only at rush hours. In more sophisticated systems, the tolls can change according to real-time conditions, incentivising motorists to use roads at less-congested periods. While the effects on the car and commercial vehicle manufacturing industry are limited, it can promote the optimisation of routes in the transportation of goods on road;
- **Vehicles-Miles-Travelled (VMT) Charges** apply according to how far motorists drive their vehicles on the roadway. Netherlands plans a transition to a VMT fee by 2014 and Denmark by 2016. This can shift passenger volumes to railways but its relevance from a global competitiveness perspective is rather limited;
- **Weight-Distance-Taxes** which charge the distance travelled and the weight of the vehicles may especially benefit when applied to the freight industry since it can contribute to enhance the cost efficiency of routes and vehicles;
- **Smog Fees** charge the number of travelled miles and the pollution generated by the vehicles per travelling distance, encouraging users to shift to more fuel-efficient vehicles.

5.2.3 Waterborne

Direct impacts

Similarly to what happened with the railways, the 2011 White-paper has set an ambitious market share increase for waterborne transport. On the multimodal logistic chains side, there is the will to have a 30% modal shift from road to rail and to waterborne transport of road freight over 300 km, till 2030 and more than 50% by 2050. Also a fully functional TEN-T core network till 2030, which comprehends several infrastructure developments on inland waterways and the Motorways of the Sea by 2030, connecting all core seaports to rail freight and, when possible, to the inland waterway system. There is also willingness to have the deployment of waterborne information management systems such as the River Information System (RIS) on inland waterways and the Community Vessel Traffic Monitoring System (SSN) and the Long range Tracking and Identification system (LRIT).

Despite its long history, implementation of the Barcelona Convention has experienced several delays and problems. According to a study carried out at Istanbul Bilgi University, the Barcelona Convention faces several challenges on the management of hazardous substances as 1) lack of ratification of the protocols from some MS, and poor state capacity on its implementation afterwards; 2) poor financing resources, including those to finance monitoring provided by national

and international NGO's; 3) improve data availability, quality and comparability and create a culture of compliance; 4) assess and achieve environmental improvements and strengthen existing regulations and build a judiciary awareness at national level; and 5) coordinate international management of hazardous substances (Oral 2006).

The shipping industry is an important source of maritime pollution, which involves both GHG emissions and ship-source pollution. Under the International Maritime Organization[61] (IMO) umbrella, the International Convention for the Prevention of Pollution from Ships, designated MARPOL Convention 73/78, was signed in 1978. The signatory parties represent 99.2% of world's shipping tonnage as in May 2013, although this representativeness' value varies significantly according to the specific pollution type, defined in 6 different annexes.

Concerning **air-pollution**, the international shipping industry is an important and increasing source of greenhouse gases (mainly CO_2), despite its efficiency per tonne-km transported, since it is responsible for the carriage of about 90% of world trade. IMO is mandated to achieve a global agreement on international shipping emissions reduction, to avoid or at least minimise the competitiveness impact of regional or national "unilateral" measures and consequent carbon leakage. So far it has not been possible for the IMO to reach such an international agreement, and after COPS18[62] last November (2012) the attention is now focused on next discussion rounds in 2013. This discussion will consider various market-based mechanisms like carbon tax, Green Climate Fund compensation or emissions trading. At this moment the EU postponed the introduction of the EU ETS scheme for the international shipping industry that should have entered into force in 2013, as defined in Directive 2009/29/EC, and it is assessing alternative market-based options. In parallel, IMO has been working in alternative measures for CO_2 emissions reduction, such as Energy Efficient Design Index (EEDI) for new ships, and Ship Energy Efficiency Management Plan (SEEMP[63]) for all ships in operation. In an assessment study conducted by the IMO for international shipping, it is concluded that EEDI and SEEMP measures can lead to almost 50% emissions reduction in 2050, measured in g CO_2/tonne mile, compared to business as usual scenario. But since it is foreseen that international shipping traffic will increase substantially, the absolute emissions value may still double in 2050 compared to 2010 figures (Bazari e Longva 2011). The SEEMP measures are mainly operational and should have a medium-term effect (2020), while EEDI measures related with technical improvements in new ships should have a significant impact only on the long-term as fleet renewal takes place.

[61] International Maritime Organization[61] (IMO), is the United Nations agency responsible for the environment (among other areas), whose main purpose is to develop and maintain a comprehensive regulatory framework for shipping.
[62] The 18th session of the Conference of the Parties to the Unit Nations Framework Convention on Climate Change and the 8th session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol
[63] "SEEMP allows companies and ships to monitor and improve performance with regard to various factors that may contribute to CO2 emissions. These include, inter alia: improved voyage planning; speed management; weather routeing; optimising engine power, use of rudders and propellers; hull maintenance and use of different fuel types" in (International Chamber of Shipping s.d.)

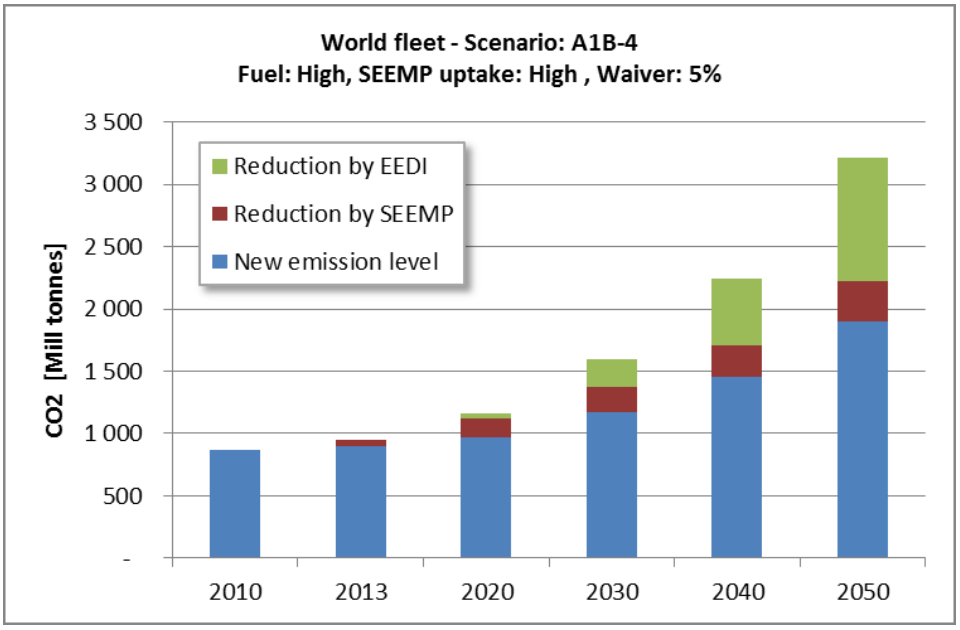


Figure 4 – Annual emission reduction by 2050 and new emissions levels (Bazari e Longva 2011)

Source: Assessment of IMO Mandated Energy Efficiency Measures for International Shipping - Estimated CO2 Emissions Reduction from Introduction of Mandatory Technical and Operational Energy Efficiency Measures for Ships, Annex pp 5, International Maritime Organization, 2011 (Bazari e Longva 2011)

Based on this same study, the implementation of both EEDI and SEEMP measures will lead to a significant fuel saving (that has increased by about 300% in the last 5 years), although it will require deeper investments in more sophisticated technologies and new practices. Also because of fuel cost savings it is very unlikely that Flag States or ship-owners will not implement EEDI measures in new fleets, due to low compliance costs and evident commercial disadvantage of non-compliance. On the other hand, SEEMP related measures for existing fleet is generally cost-effective, and has been made mandatory by IMO regulations since 2013. International Chamber of Shipping (ICS) states that only an international agreement under IMO regulations and with the involvement of governments can be possible to deliver global and uniform CO_2 emissions reduction without serious distortions in international shipping markets.

Marine activity contributes significantly to **ship-source pollution**, arising from accidents and as a result of deliberate discharges, as tank-cleaning operations or waste oil disposal. Directive 2005/35/EC, amended by Directive 2009/123/EC, incorporates into Community law the Marpol Convention 73/78 on ship-source pollution, aiming to harmonise its application and create common rules on criminal penalties that facilitate effective cooperation and methods of investigation within and between MS. This directive was severely criticised by the industry for its international law enlargement because it introduces criminal penalties to pollution acts caused by "serious negligence" and does not include those caused by "intent or reckless acts" and also because only the ship owner or the capitan can be liable. Notwithstanding, no negative impact assessment was found concerning competitiveness for the industry, since this Directive applies to all types of vessels irrespective of their flag.

Ships' dismantling is another source of environmental concern. An end-of-live ship can be a source

of hazardous substances as heavy metals, asbestos, hydrocarbons, among others. But is also an important source of raw materials, as iron from its hull, among several others if recycled in a proper matter. Based on the principle of "polluters-pay" and international agreements as the Basel Convention[64], EU has specific legislation to deal with waste matters, as the Waste Shipment Regulation (Regulation (EC) No 1013/2006), on the control of transboundary movements and disposal of hazardous streams. According to this Regulation, a ship going to dismantle is classified in itself as hazardous waste, and has to be dismantled in an OECD country. But an IMO research found that 90% of ship dismantling has been made in South Asian countries as Bangladesh, India and Pakistan, including EU flagged ships. Several factors have been contributing to this reality: 1) the international nature of the shipment industry and the easiness that daily business reality has shown in reflagging processes or a last cargo to non-OECD countries, which have been allowing rendering both international rules and Union legislation; 2) the high externalisation of external costs of this activity and financial incentive[65] of dismantling ships in locations with low labour costs, poor labour conditions, lower environmental concerns and high raw materials (i. e. iron) demand, as long as the trip costs are covered by a last cargo and/or the size (and corresponding raw material weight) of the ship turns it advantageous; and 3) there is a lack of recycling capacity availability among OECD countries, in particular for the largest ships, being most of it at the European level in Turkey which is specialized on the recycling of government-own and Mediterranean trading ships.

Similarly to what happens with other subjects, competitiveness issues can only be minimised with international legislation that brings all the parties to the same rules and, in this particular case, to the internalisation of recycling costs (and benefits). Therefore, and after several years of previous work among IMO and other stakeholders, it was signed in 2009 the "Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships" that regulates the design, construction, operation and preparation of ships for dismantle, the operation of ship recycling facilities and the establishment of appropriate mechanisms for certification and reporting requirements. There are already several guidelines to assist states in the early implementation of their technical standards, but the entry into force of the convention will probably not happen before 2020. The EU is preparing specific legislation to incorporate the Hong Kong Convention (Com (2012) 118 final), and have better conditions to guarantee that EU flagged ships are dismantled in sound manners and that the new ships obey to its regulations. But this effort will only be effective after recycling yards countries globally (Turkey, China, Bangladesh, Pakistan and India that account for around 95% of world capacity) ratify Hong Kong Convention, and the option of reflagging to a non-Party State is no longer useful.

[64] „The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted on 22 March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland, in response to a public outcry following the discovery, in the 1980s, in Africa and other parts of the developing world of deposits of toxic wastes imported from abroad" - in http://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx

[65] The residual value can range from 17% and 23% of the replacement of new building price. The price that dismantle yards pay in Turkey per light tonne can be around $150 less than the prices paid in South Asia (Mikelis 2012)

Research impacts and industrial outcomes

In recent years public concerns regarding the environmental impacts of maritime transport have increased. This is because maritime transport is the fifth largest contributor to air pollution and carbon emissions – a ship emits 30-50 times more sulphur oxides per tonne-km than trucks and releases twice as much nitrogen oxides per tonne-km that a truck, and the growth rate of trade makes the problem even more pressing. Therefore, several studies, especially related to the external costs of transportation, pollution prevention, regulation and modal shift from road to sea have been published:

- (Miola, et al. 2009) presented a report about the external costs of maritime transport where all its environmental impacts (at sea and in ports) were identified, analysed and estimated. It aimed to an easier prevention of maritime external costs and turn maritime transport more competitive. The ultimate objective of this report was to highlight the gaps that have to be filled in future research works;
- (Bailey e Solomon 2004) wrote a paper about the alternatives that can make significant improvements in air quality at ports such as the switch to cleaner versions of diesel fuel and restricting idling - as the most inexpensive approaches - or transitioning to natural gas or propane; retrofitting, repowering or retiring older diesel equipment and vehicles - as the more aggressive approaches;
- (Miola, et al. 2010) c conducted a research paper about the regulation of air emissions from ships. Through the identification and estimation of air impacts of maritime transport and through the analyses of the policy options to abate air emissions from ships, this report managed to provide a valuable information about the tools necessary to help define a policy strategy for regulating air emissions and about the various insights into how best design and apply efficient and equitable instruments;
- (Douet e Cappuccilli 2011) wrote a paper to clarify why despite the European policies to incentivise freight modal shift from road to sea, EU efforts remain disappointing. One of the main obstacles pointed was the “contradiction between the EU position of expecting that the market should provide and take the risk of providing the seaway infrastructure while tending to ignore that competing roadways and railways infrastructures are subsidised by Member States and by EU grant aid such as TEN-T”;
- (Baindur e Viegas 2012) presented a case study where they identified the effective business strategies and policy actions adopted in different markets - such as Japan and maritime regions surrounding EU - in order to support MoS (Motorways of Seas) initiatives. This analysis provided valuable learning to understand the influence of various internal and external factors of MoS projects, what allows the improvement of the quality of services.
- The PROPS-Promotional Platform for short-sea shipping and intermodality main objective is to increase the use of short sea shipping, leading to modal shift from long-haul road freight to sea supporting the sustainable development of European transport. To improve the quality of services to bring shippers to use SSS services increases the competitiveness of maritime transport;

- EU co funded research researching the impacts of the future requirements of Annex VI of MARPOL Convention on Short Sea Shipping has studied the potential modal shift that may occur in the Mediterranean and the North East Atlantic if a maritime fuel sulphur content limit 0,5% is introduced in 2015, possibly further reduced to 0,1% in 2020. It predicted *"an approximate 10% loss in cargo volumes from RoRo to road/rail alternatives"* in Northern Europe which would not be offset by implementation of Eurovignettes as well as a shift of cargo from LoLo to land based transportation as a result of the introduction of the 2015 MARPOL sulphur limit of 0.1%[66];
- The STREAMLINE (Strategic research for innovative marine propulsion concepts) project, cofounded through the 7th FP, has three prime objectives: demonstrate new propulsion concepts that augment efficiency in terms of noise, vibration and cavitation; optimise current state- of-the-art systems; and optimise hydrodynamic performance of new propulsion concepts through development of Computational Fluid Dynamics (CFD) methods. The expected results of STREAMLINE Project are an efficiency increase of at least 15% and the optimization of current concepts, so that improvements can be implemented in a short period of time (STREAMLINE Project n.d.).
- A project on the Pollution Prevention and Control-Safe Transportation of Hazardous Goods by Tankers (POP&C) developed framework tools for the methodological assessment of risk of oil tankers, so that it would enable more informed decisions concerning the design, operation and regulation of oil tankers (EC 2012 i).
- HoverSpill was elaborated to answer to oil spill emergencies through the development of a prompt intervention system based on a fast and compact amphibious hovercraft. It was designed for rapid and extensive cleaning operations with low environmental impacts and it is easy to transport and use in difficult areas due to the platform's weight and dimensions and has autonomous amphibious performances. Besides, it allows savings of 30% of the total cost of coastline remediation (EC 2013 c) (HoverSpill 2011).

Ships recycling is another important issue approached by many papers and articles such as (UNEP 2003), (Mikelis 2006), (DHI 2007), (IMO 2009), (COHI 2009), (Mudgal, et al. 2010) and (van Gelder, Hogenhuis-Kouwenhoven e Kloostra 2013). These studies provide guidance to ship-owners and to countries which hold facilities for ship dismantling in order to encourage the shipping industry to look for green ship design and pre-clean ships during operational use, to ensure that ship-owners will recycle their ships in facilities that are compliant with the new IMO Convention (The Hong Kong Convention) and to provide information and recommendations on procedures, processes and practices about ship dismantling.

The maritime industry has been a useful instrument when it comes to the reduction of shipping environmental footprint. According to (DNV 2012), **maritime emissions** of different nature have been or can be further reduced through the use of many instruments, that may not only improved environmental footprint of maritime services but also bring along efficiency gains by either reducing energy/fuel consumption, improving engine efficiency and/or reducing the risks of

[66] SKEMA. 2010. Impact study on the future requirements of Annex VI of the MARPOL Convention on SSS. Deliverables: Task 2. Grant Agreement No. TREN/FP7/TR/218565/"SKEMA"

environmental accidents for which the company may need to pay:

- SO2 emissions have been reduced through the adoption of waste heat recovery systems which convert energy from ships exhaust gases from propulsion into electrical power for use on-board vessels, generating significant savings in fuel consumption from the main engine.
- NO2 emissions can be reduced through the adoption of several technologies that lower the temperature of combustion as humid air motors, direct water injection, exhaust gas recirculation and fuel-water emulsification.
- CO2 emissions are a direct result from thermal combustion of fuel that can be reduced by many different ways such as:
  - adoption of hybrid auxiliary power systems;
  - change of fuel type to liquefied natural gas;
  - appliance of a waste heat recovery/booster system which allows for up to 12% savings on primary energy (fuel) and thus CO2;
  - adoption of hydrogen systems which can be up to 50% more efficient than existing engines;
  - and implementation of high efficient marine systems that reduce ships overall resistance through water, giving the average fuel saving of 2-5%, thereby reducing emissions.

In what concerns **ships' waste**, 70% of ships garbage is immediately sink to the bottom of the ocean occurring out of public eye (EMEC 2010). So, the equipment manufactures developed various methods of waste treatment such as:

- the use of waste compressors to reduce rubbish volume in order to enable the storage on-board before waste being offloaded to shore based facilities;
- and the use of plasma technology which allows waste reduction into a non-toxic sludge.

Waterborne management systems encompass several functions besides security and safety of the human life in the sea, like environmental concerns caused by accidents or ship-source pollution. These systems are mandatory and used worldwide, with global manufactures from Europe, USA and Japan and several plants in Europe. Some of these management systems are:

- **Vessel Traffic Services (VTS)** that plays a significant role in marine traffic management, similar to air traffic control for aircrafts. They are implemented by harbour or port authorities and aim to improve the safety and efficiency of vessel traffic and to protect the environment. They decrease vessel congestion, critical encounter situations, and the probability of a marine casualty resulting in environmental damage (EC 2008 a);
- **River Information Services (RIS)** are defined as a concept of harmonised information services to support traffic and transport management in inland navigation, including interfaces to other modes of transport (TRKC 2010 b). They contribute to better energy

efficiency by reducing fuel consumption and consequently carbon emissions as a consequence of better voyage planning and more reliable scheduling;

- **The Long Range Identification and Tracking (LRIT)** system is designed to collect and disseminate vessel position information to the flag-state authority, received from IMO (International Maritime Organization) member States ships that are subject to the International Convention for the Safety of Life at Sea (SOLAS). LRIT information would provide significant added value through an improvement of the knowledge of ships positions and identity increasing safety and marine environment protection.

5.2.4 Air

Direct impacts

The 2011 White Paper also specifies goals for the aviation sector, ranging from the development and deployment of new and ambitious fuels and propulsion systems (Low-carbon sustainable fuels in aviation to reach 40 % by 2050), a role in the optimisation of multimodal logistic chains, with the connection of all core network airports to the rail network (preferably high-speed) and the improvement of Air Traffic Management with the deployment of the air traffic management infrastructure (SESAR), which was already assessed in the chapter on transport policy.

The main environmental concerns of the aviation sector are related with noise, at and around airports, and emissions that effects air quality and have global effects on climate change.

Despite the aviation sector reduced by 75% its **noise emissions** over the last 30 years (European Comission 2013), airports are being victims of their own success and facing operational limitations and opposition to expansions and new constructions. Directive (2002/30/EC) lays down a common framework of rules and procedures to stringent noise standards to be imposed at the most noise-sensitive airports (more than 50 000 movements per year and city airports) considering similar operating restrictions at airports with broadly comparable noise problems in an internal market compatibility philosophy. However, this legislation was based on International Civil Aviation Organisation (ICAO) noise standards and applies to all flights and airports within EU and arriving/departing from the EU. This meaning its impact on European carriers might not be different from that on extra EU airlines. . ICAO developed a concept of "balanced approach" to aircraft noise management, which exploits four principal elements, 1) reduction at source, 2) land-use planning and management, 3) noise abatement operational procedures, and 4) operation restrictions, which can include movement caps, noise quotas and banning the operation of certain noisy aircraft at noise-sensitive airports. The latter is the most sensitive measure, since it needs to account balances between the environmental interests and competitiveness of the airline industry, airports and the interests of developing and developed States.

This EU Directive is facing an amending process after a stakeholders' consultation revealed a differentiated implementation of operation measures among EU airports and a limited impact on noise reduction. Stakeholders pointed out two main reasons for this: 1) the definition of noisy aircrafts is obsolete and the phasing-out period inappropriate, and 2) there are potential competition

distortions due to distinct operating restrictions considered at airports with broadly equal noise problems, which can be due to insufficient precision of the existing rules describing how to carry out the general noise assessment process (European Comission 2011).

The **air-pollution** from the aviation sector is being managed by the EU in a three-fold: 1) R&D under the 7th Framework Programme (Clean Sky Joint Technology Initiative); 2) modernisation of air traffic management in Europe, within the Single European Sky legislation (see also previous chapter); and 3) inclusion of aviation sector on the EU Emission Trading Scheme.

Impacts of the Clean Sky Technology Initiative are assessed under the research impacts below. The **Single European Sky** (SES) and its technological component, the **Single European Sky ATM Research (SESAR)** are expected to have a positive net effect on total CO2 emissions from 2014 to 2030 despite the additional increase on air traffic, compared with a scenario in which no new ATM technologies are deployed (SESAR 2011). This is partly due to improvements with regards to delays, leading times and reduction of route's length that have already been reviewed in the former chapter. The market-based incorporation of aviation in the EU Emission Trading Scheme (Directive 2008/101/EC) is experiencing strong opposition from airlines, investors and foreign governments, being accused to be a unilateral measure of EU, violating international law and agreements under ICAO. Therefore, its application on flights arriving at and departing from EU airports has been postponed in expectation for an international agreement in the framework of ICAO this September. Nevertheless, the experts are not anticipating a strong impact of this measure on emissions reduction from this activity on the short-medium-term, based on 3 major arguments. First, the demand for more fuel efficient aircrafts technologies will keep being determined by the oil price, unless the EU ETS are priced above EUR 65 (and not EUR15) (Moss 2011). This same market expert sustains that new aircraft will only fly 1% of aircraft kilometres by 2020 and 11% by 2030, and that Airbus and Boing are one decade distant to release new technologies to replace their emissions inefficient cash-cows models. Second, the marginal abatement costs on aviation are higher compared to other sectors, being more cost-effective to buy extra credits rather than new fleet (Winchester, Wollersheim, et al. 2011). And third, depending on competition conditions and the ability of each company to pass on this cost to its customers, this measure can be more or less cost neutral and consequently more or less effective on emissions reduction. On an extreme case, this measure can raise companies profit and represent a transfer to foreign countries if companies are able to charge customers all emissions costs, including the corresponding amount of the free allowances given by the EC (Malinai, et al. 2012).

Research impacts and industrial outcomes

With the increase of European airports congestion and traffic forecasts prediction of steady growth for the next 15 years, it is necessary to find alternative ways to optimize available capacity, securing safety needs at the same time. European Commission has several projects concerning this issue, with a particular concern on the following three:

- The improvement of the environmental performance of aircrafts through studies such as the enforcement of biofuels and Clean Sky;

- The modernisation of air traffic management by the Single European Sky (through SESAR's technology) and AIRE's environmental initiative;
- Economic incentives to greener operations, namely the trade of emission rights.

Clean Sky Joint Undertaking (CSJU) is a Public Private Partnership between the European Commission and the Aeronautical Industry, which aims to speed up technological developments that will allow cleaner solutions for air transportation, reducing its environmental footprint. More specifically, Clean Sky aims to coordinate aeronautics research on a European scale, accelerate the development of clean air transport technologies, develop knowledge generation and its application and set a competitive air transport system. It was created to run until the end of 2017, as part of the 7th framework programme for research and technological development, and intends to reduce CO2 emissions by 50%, NOx by 80% and noise by 50% until 2020 (EU 2011 c). In Figure 5 are presented the technology domains that will form the scope of the Clean Sky programme, in order to achieve ACARE environmental objectives.

Figure 5: – Technology domains meant to achieve ACARE goals (Clean Sky a)

Source: Figure from Clean Sky Web site (Clean Sky a).

The technology domains presented above are integrated in the Clean Sky programme through six Integrated Technology Demonstrators (ITD) and one Technology Evaluator, which will assess the performance of the technologies developed. Each ITD is led by two of the founding members of CSJU[67] which are committed for the whole duration of the CSJU (Clean Sky a). The six ITD that constitute Clean Sky are the following (Clean Sky b):

- **Smart Fixed Wing Aircraft (SFWA)** – new aircraft configuration and active wing technologies;

[67] EADS, Airbus, Eurocopter, Fraunhofer, Alenia Aermacchi, Agusta Westland, Safran, Thales, SAAB, Dassault aviation, Liebherr and Rolls-Royce.

- **Green Regional Aircraft (GRA)** – low-weight aircraft using smart structures, integration of technology developed in other ITD's (energy management, engines and new system architectures, between others), and low external noise configurations;
- **Green Rotorcraft (GRC)** – innovative engine installation for noise reduction and rotor blades, integration of diesel technology, lower airframe drag and advanced electrical systems for fuel consumption reduction and elimination of noxious hydraulic fluids;
- **Sustainable and Green Engines (SAGE)** – new configurations such as intercoolers and open rotors and design and build of five engine demonstrators to lightweight low pressure systems and integrate technologies for low noise, low NOX, high efficiency and low weight cores;
- **Systems for Green Operations (SGO)** – all-electrical equipment, thermal management, systems architectures, capabilities for "green" trajectories and improved ground operations so that the aircraft can fully exploit the advantages of the Single European Sky;
- **Eco-Design (ECO)** – green design and production, withdrawal and recycling of aircraft through optimal use of energies and raw materials, resulting in the minimization of the environmental impact of the products life cycle.

A formal assessment of Clean Sky achievements is not yet available due to administrative delays. Yet, there are positive indications which give confidence that Clean Sky should meet its objectives substantially. As expressed in Clean Sky web-page (Clean Sky C), a first full-scale simulation and performance evaluation of the programme's progress pointed at the following results:

- 130-180 seat, short/medium range aircraft equipped with open rotor engines and laminar-flow wing technology could deliver up to 30% better fuel efficiency and related CO^2
- Emissions reductions when compared to equivalent 2000 aircraft
- Next-generation regional aircraft for 90-130 passengers using advanced turbo-prop and turbofan engines (including a new Clean Sky 'geared turbofan' solution), and incorporating advanced aerodynamics, structures and energy-efficient systems show similar potential - against today's best in-service aircraft
- Important reductions in noise nuisance are foreseen in business aviation and rotorcraft operations. For instance, new business jet designs could deliver a 2/3 reduction in noise affected areas during take-off
- Successful implementation of a Technology Evaluation process involving robust and independent analysis of performance gains and extensive simulation of aircraft in airport and air transport system level scenarios.

The development of biofuels for air transportation is another way of improving aircraft's performance, and the main players in the industry are already investing in this type of fuel. In 2012, Airbus, Boeing and Embraer agreed to develop affordable aviation biofuels and pursuit collaborative opportunities in which they would try to accelerate the availability of sustainable new jet fuel sources. Through the use of biofuels it will be possible to reduce air transportation carbon emissions (Biofuelsdigest 2012).

SESAR, which was already reviewed on the chapter of transport policy from its "cost-effective-ness" side, also aims to decrease by 10% the environmental impact of each flight, without compromising on safety. It is estimated that more than 80% of the projects have environmental concerns, covering the different flight stages, and themes as emissions, noise and local air quality and the set-up of an environmental validation framework (SESAR 2010). Air traffic management improvements can reduce significantly each flight emissions and noise pollution by developing new technologies and optimising procedures on the flight different stages:

- Departure – a single continuous climb is more energy-efficient that actual often climb in a serious of steps separated by periods of level flight;
- Flight paths – currently aircrafts have to follow set air corridors that usually make route longer than necessary;
- Landing slots - reducing air traffic congestion on the arrival destination that obliges aircrafts to circle and descend in stages while awaiting for a landing slot;

In addition, introducing time as a fourth dimension on all the three above phases of the flight so that pilots can choose the optimum flight path, use the most economic altitude and speed and have continuous climb and descendent approaches has significant environmental impacts on noise and emissions.

SESAR and NEXTGEN (United States major air traffic control programme) established a joint initiative called Atlantic Interoperability Initiative to Reduce Emissions (AIRE), signed by the European Commission and the Federal Aviation Administration (FAA) within the framework of a Memorandum of Cooperation (MoC) whose overarching objectives are coordinating Europe's and United States' air traffic control modernisation as well as enhance interoperability between the SESAR and the NextGen programmes in order to facilitate the global ATM standardization (EC 2011/C731). This large-scale environmental initiative brings together aviation players of both Europe and United States, encompassing 18 projects just on the European side, involving 40 airport, airline, industry, service provider and air navigation partners, focusing on complete green flights, such as transatlantic flights with the A380 (EC 2012 g). AIRE was launched in 2007 and has delivered promising results with CO2 emissions savings ranging from 90 to 1250 kg per flight and accumulated saving of 400 tonnes on 1152 demonstration flights (GreenAir 2010). As Patrick Ky (SESAR's Executive Director) underlined: *"the SESAR goal of 10% savings per flight is still far away, but the AIRE approach, exploiting the full potential of today's technologies, shows that we will get there. The value of working together with common goals is enormous"*.

Other research initiatives involve noise abatement measures at source. RECORD - Research on Core Noise Reduction (2013-2015) is a FP7 co-funded project that aims to develop reliable prediction tools to assist the design of low core noise aero-engines. In RECORD the fundamental understanding of core noise generation and how can it be reduced will be achieved by combining the research competence of all European experts in universities and research organizations working in this field of core noise.

But research alone does not enhance the competitiveness of aerospace industry if it does not manifests itself in the use of new technologies and materials. Some technologies that the industry is implementing or is about to implement, benefit one or more of the issues above mentioned, such as the blended wing body (BWB), Geared Turbofan (GTF), Open-Rotor, Composites and the CLEEN program.

The BWB is a potential technological advancement that consists in a new aircraft design, which would consume less than 20% fuel than the conventional aircrafts, diminishing its operational costs as well as reduce noise due to its lighter weight and reduce gases emission. It is likely that this new type of aircraft will enter the market through an American company or consortium, as the US air force already has BWB aircrafts – the Northrop Grumman B2 Bomber – and therefore have developed the required expertise in avionics, structures and engine integration, between other technologies (Clearwater 2010).

There are two new propulsion engines currently under development – the Geared Turbofan (GTF) by Pratt & Whitney and the Open Rotor by General Electric (GE) and Rolls-Royce. Although both propulsion engines are extremely promising in terms of fuel efficiency and emission reduction, GTF seems more probable to enter the market sooner, as it has already been selected as the power source for Mitsubishi regional jets and Bombardier C-series. The GTF is expected to achieve double digit reductions in fuel efficiency and 50% reduction in noise comparing to currently available engines (Clearwater 2010).

One of the ways of achieving fuel efficiencies is by the creation of light-weight-aircraft through the use of composite materials, as they are 20-35% lighter than aluminium, more reliable, can be made in complex shapes and have a higher strength-to-weight ratio. Composites costs are higher than the ones of traditionally used aluminium and titanium but it is expected that its costs will decline significantly in the future due to economies of scale and automation of the manufacturing process. The new Boeing 787 Dreamliner is the first aircraft with 50% of its weight from composite materials, while Airbus' equivalent was the A350 XWB. Airbus claims that besides fuel efficiency and noise reduction, composite materials also enable extending the periods of time between heavy maintenances from 6 to 12 years as well as reduces requirements with fatigue and corrosion related inspections (Airbus 2013 b) (Clearwater 2010).

The CLEEN program is a conjoint initiative between Boeing and Federal Aviation Administration (FAA) that aims to reduce airplanes emissions of fuel and noise through the progressive development of new engine technologies with the potential capability to reduce greenhouse emissions and community noise. Some of the technologies that will be developed and tested in this program are ceramic matrix composite acoustic engine nozzles and adaptive wing trailing edges that *"(…) help tailor the wing configuration to reduce fuel burn at take-off, climb and cruise, and to reduce community noise at take-off and landing"* (PR Newswire 2012). Within the CLEEN program Boeing also conducts research in aviation biofuel made from biomass sources (lowering carbon emissions) and the efficiency augment of the global air traffic control network (reducing passengers wait times and reducing the carbon footprint of air travel) (PR Newswire 2012).

Airbus is committed with the reduction of noise and fuel emissions as well, as more than 90% of the €2 billion the company invests per year in research lead to environmental benefits for the aviation sector. Airbus works with their suppliers in order to achieve these reductions, particularly through the progressive introduction of new materials to reduce the aircraft's weight (and consequently its fuel consumption), optimise the propulsion systems and the overall aerodynamic efficiency. Some of Airbus aircrafts already present a number of these characteristics (Airbus 2013 a) such as:

- The A380 was the first commercial aircraft to incorporate 25% composites, which enabled to reduce by 20% its fuel consumption compared to its closest competitor. Besides, A380 also presents low-noise nacelle designs, acoustic treatment and low engine noise technologies that satisfies the most strict noise requirements of international airports;
- The A350 XWB is 25% more fuel efficient than its current long-range competitor, partly due to its Rolls-Royce Trent XWB engines. It has high compliance margins in what hydrocarbons, carbon monoxide, smoke and NOX limits concerns, 53% of its structure is made of composites, and is up to 16dB bellow the ICAO Chapter 4 limit of noise.
- The A320neo allows a fuel burn saving of 15%, the majority of it (12,5%) due to its new engine options: the PW1100G Pure Power from Pratt & Whitney and CFM International's LEAP. If the whole single-aisle existing fleet was to be replaced by A320neo, it would result in savings of 20% per year with savings of 87 million tonnes of carbon dioxide.

5.3 Assessment of Impacts

Politics is made of consensus and of the ability to reach the right formula to balance the different stakeholders' expectations and needs. On the one hand, the transport sector is a serious threat to environment and citizens' health, on the other hand, however, it is an important generator of economic growth (GDP contributor, employer of skilled workers), a fundamental facilitator of other economic sectors and an essential source of people's mobility, and the consequent welfare.

All stakeholders recognize the harmful effects that transport activity has on the environment and the need to reduce its impacts. But the different stakeholders tend to have different urgencies and different points of view on whom should be the main contributor on, for instance, new technologies and production processes investments and how the internalisation of external costs should be handled.

The EU environmental policy addresses many comprehensive and complex issues, which not only encompass the short to long-term impacts of anthropogenic effects on environment itself, but also on the competitiveness of European industry. The goal of the first environmental legislation was to develop the EU internal market, and setting of common standards among MS to facilitate economies of scale. Nowadays, despite the leading role of the European Commission on environmental actions that often anticipate other world geographies normative rules, there is precaution on the way legislation is formulated and/or entered into force. There are several levels of formal and informal legislation aiming to define a medium-to-long term strategy and give medium-to-long term guidance, planning certainty and time for the industry to adapt, as the Environmental Action Plan, the White Paper on Transports and several sectorial strategies and roadmaps.

Furthermore, the EU has been using intermediary measures as voluntary agreements with the industry (as the Voluntary Agreement on Passenger Car CO_2 emissions previous to specific binding legislation) and incorporated international standards and measures reached by the industry associations, specialised United Nations agencies as the IMO and ICAO and governments agreements under the COP umbrella. But reaching consensus is not always possible as postponement of more sensitive legislation such as the integration of commercial international aviation and shipping emissions on EU ETS has shown.

There is no convincing independent evidence that environmental policies harm competitiveness of a country or a region, or a given industry's products and/or service provision. However, the opposite is also true, i.e., there is no hard evidence that environmental policies contribute to competitive advantage, especially in the long run (OECD 2008). In the short-run environmental regulation can increase the industry's costs of production, and thus reduce the number of jobs in affected sectors. However, at the same time, it may also create demand for eco-oriented new businesses and green products and jobs, while in parallel decreasing the health-care costs and lengthening the life expectancy.

A large part of environmental legislation focuses on transport because this sector is considered a driving force behind climate change. Based on the assumption that climate change can disrupt economies and that the costs of inaction will be much higher than reducing the GHG emissions, the EC works on defining rules of transition to a low-carbon economy (EU 2011 a). But climate change by itself is a very controversial subject, with the scientific community having different opinions about the real scale of anthropogenic cause-effects on global warming and the entire ecosystem, and the consequent impacts on the costs of functioning of the EU economy. However, a consensus prevails that noise and local air pollution, particularly in the urban areas, need to be reduced to quell congestion, including its economic costs and enhance population health. On the other hand, intentions behind the decarbonisation of the European economy are also grounded in concerns over energy security due to EU high dependency on extra-European oil suppliers (see also chapter on energy policy). Also, the last years' escalation of oil prices can harm the EU internal market and its industry's global competitiveness, particularly as compared to the US and other energy-rich, and highly developed economies. As 96% of transportation energy comes from oil, the EU needs to import around 90% of its crude oil consumption to meet this demand.

The growth in passenger and cargo mobility has in the past been strongly correlated to rise in the GDP. The expectation that this trend will continue over time has prevailed. Yet, since reduction in social welfare and economic stagnation are not valid options, a transition to low-carbon economy needs to be achieved through innovation and behavioural changes. EU policy regulations aim to make a strong push in this direction.

Despite several sectors have been reducing its GHG emissions, the transport sector kept the raising trend, due to demand increase. This sector accounted in 2006 for 13% of GHG emissions and is the second in the world CO_2 emissions producer from fossil fuel combustion. Of those, around 70% comes from the road traffic and 12.5% from international maritime transport. On the other hand, around ¼ of transport CO_2 emissions are generated by urban transport (OECD/ITF 2009). Despite

the economic crisis, 2010 CO_2 emissions from fossil fuel combustion from the transport sector kept a similar percentage value.

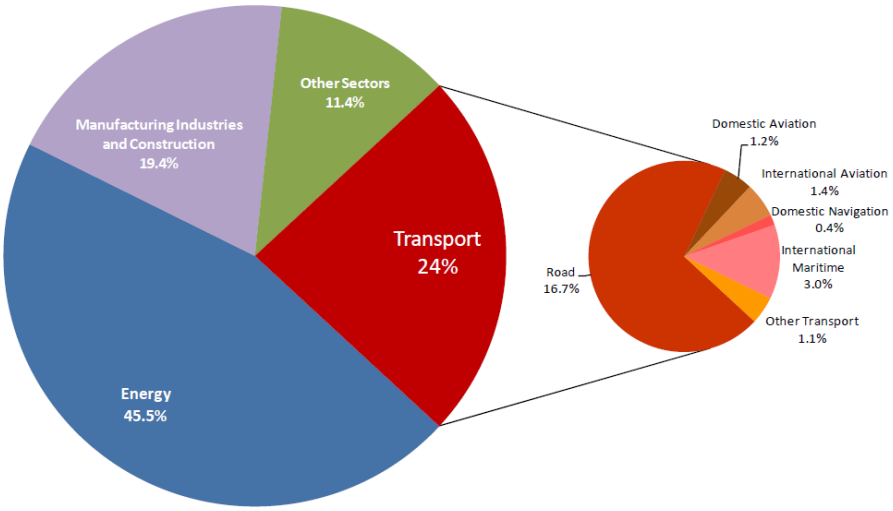


Figure 6: 2006 World CO2 Emissions from Fossil Fuel Combustion (OECD/ITF 2009)

Source: Reducing Transport GHG Emissions - Opportunities and Costs, Preliminary Findings, pp 7, (OECD/ITF 2009)

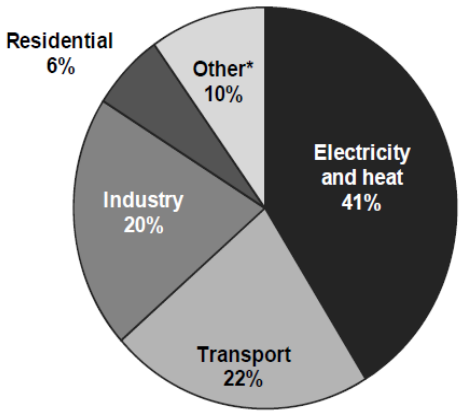


Figure 7: 2010 World CO_2 Emissions from Fossil Fuel Combustion by sector (OECD / IEA 2012)

Source: CO_2 Emissions from Fuel Combustion - Highlights, pp 9, (OECD / IEA 2012)

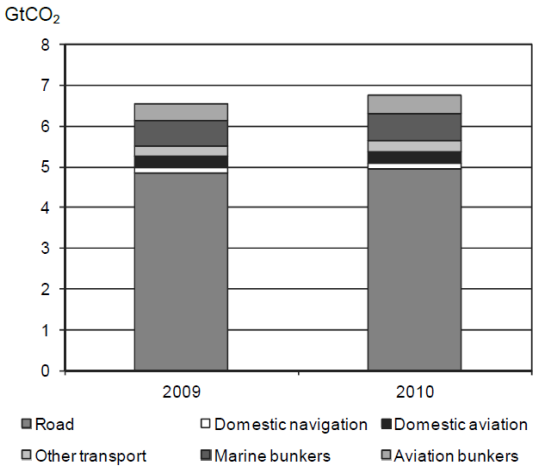


Figure 8: 2009 & 2010 World CO2 Emissions from Transport (OECD / IEA 2012)

Source: CO_2 Emissions from Fuel Combustion - Highlights, pp 10, (OECD / IEA 2012)

EU has been using both the command-and-control measures and market-based instruments in environmental legislation. Some proponents of regulations based on market instruments (such as environmental related taxes and fines) see these measures as delivering a double dividend – the environmental improvement and higher public revenues. However, on the one hand extra taxes can be seen as competitiveness impairment, on the other hand the growth in public revenues can create

scope for labour tax cuts, boosting European employment (Eurostat 2012). Taxes and trading schemes can additionally provide incentives for investment in innovation and /or new technologies which may come to fruition in mid-and long terms (OECD 2008). The environmental taxes in EU-27 countries amount to 3% of GDP which, on average, represents roughly 6% of the overall revenue-raised taxes (Eurostat 2012). Nevertheless, these taxes have not been used as an overall instrument of environmental protection. The main sources of that are transport fuel taxes, where the pollution-related part represents only a small portion of the total taxes (EU 2011 a). However, the overall fuel taxes play an important role for the GHG emissions reduction by the transportation sector, since they reduce the travel demand and guide technologies deployed by vehicle manufacturers (OECD/ITF 2009).

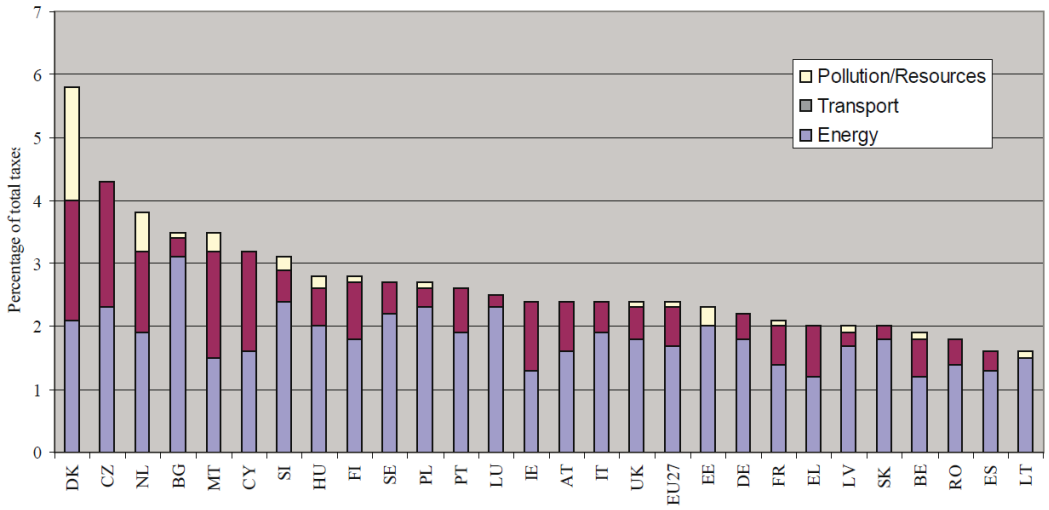


Figure 9: EU Environmental taxes as % of total taxes, in 2008

Source: EU Environment Policy Supporting Jobs and Growth, p. 16, European Commission, 2011(EU 2011 a)

The European Union adopted the ambitious target for reduction of GHG emissions from transport by 60% in 2050, as compared to the 1990 level. Technological innovation, changes in travel behaviours and efficiency improvement will play an important role in the fulfilment of this objective, but with very different cost levels. Marginal abatement costs curve is a methodology that can motivate the stakeholders to undertake cost-effective green investments (OECD/ITF 2009). On the other hand, there are certain measures that, although necessary in the long run, are not so cost-effective but and, thus, may need to be encouraged at the early stage by availability of commercial guaranties. Some examples pertain to measures propagating alternative energy sources and vehicles powered by electricity and hydrogen. However, dramatic technology developments and availability of large investment funds may be required to make these vehicles reasonably priced and also stimulate to short-termed fleet renewal of modes that have slower fleet turnovers, such as aviation and maritime sectors.

The rising cost of energy may spur several emission mitigating technologies to be developed and adopted at relatively low cost as they might cause direct fuel savings. Yet, a large-scale production of more eco-friendly transportation fleet may require much higher financial investments from the industry, and much higher consumer expenditures (OECD/ITF 2009). A general consensus in the field indicates that despite its major role, technology changes in vehicles will not be enough to reduce the emissions beyond certain level. The recent research studies of marginal abatement costs

in aviation and production of heavy duty vehicles (HDV) have strengthened this conjecture.

While the visions and pathways towards how to make the European transport industry more competitive at a global level are defined, there is little evidence as to how the past and the recent environmental policies have affected the industry's competitive position. Transport sector is intrinsically related to other sectors, and many environment related measures already in place and future ones may generate co-benefits and overheads that should be accounted for regarding the intra- and extra-EU competitiveness. But the complexity of factors and interrelated consequences turn to jeopardise comprehensive and independent impact assessments.

5.4 Environmental Policy Impacts on European Transport Industry

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
All	**Environment Action Programme** - General environment action programmes, developing EU environment policy since the early seventies. The 6th EU Environment Action Programme covered the period 2002-2012. The 7th EU EAP is on a proposal phase.	EU Environment action programme	Consolidate and complete almost all environmental media, with the exception of soil; ensure a high level of environmental protection and guided by the principles enshrined in the Treaty of precaution, prevention, rectifying pollution at source and 'polluter pays'; Set common goals and standards for all MS concerning the reduction of anthropogenic emissions towards a low-carbon economy, improve the resource efficiency and foster the internal market (with economies of scale)	Being a mid-to-long-term strategic framework, it ensures predictability on the measures that industry players have to face
All	**White Paper** – Roadmap to a single European transport area – Towards a competitive and resource-efficient transport system	COM (2011) 144 final	Define 10 goals to guide policy actions and measure progress to achieve a 60 % reduction in CO2 emissions and comparable reduction in oil dependency. Those goals include phasing out conventionally fuelled cars from cities by 2050, and a 50% shift in middle distance passenger and longer distance freight journeys from road to other modes and are underpinned by 40 concrete initiatives to be developed over this decade.	
All	Trans-European networks: towards an integrated approach (TEN-T)	COM (2007) 135	link the EU regions through provision of joint transportation, energy and telecommunications networks; facilitate economic growth and employment; optimise capacity utilization and soften environmental impacts making the EU better connected and competitively more potent, by enabling goods and people to move faster between the Member States.	Since 80% of the 30 priority projects are related with railways and waterborne infrastructure improvements, TEN-T may enhance the competitiveness of these modes compared to air and road. However it is questionable if by doing so rail and waterborne do not increase their dependency on public support.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
All	Limiting Global Climate Change to 2 degrees Celsius The way ahead for 2020 and beyond	COM (2007) 2 final	set up a strategy on climate change for 2020 and beyond devise more specific steps to mitigate the effects of climate change and support the EU in achieving a 30 % reduction in greenhouse gas emissions identify options for "*realistic and effective*" measures in the EU and beyond that will allow to meet the 2ºC target	Less economic growth in the short and medium term against an increased readiness to meet challenges in the long term.
All	Reducing greenhouse gases by 2020	Decision No 406/2009/EC	transform Europe into an extremely energy-efficient and low greenhouse-gas-emitting economy reduce by 20% gas emissions as compared to 1990 levels of the overall greenhouse released by its 27 MS or by 30% if the other major economies agree to apply their fair share of global emissions reduction efforts; set out minimum contributions for MS in terms of greenhouse gas emissions from 2013 to 2020 in a linear trajectory, in which MS emissions must be lower than the corresponding annual emissions quota and allowances not used are carried forward into the future	Unclear, since transport sector has been increasing its total GHG emissions due to demand increase. Further measures are necessary.
All	Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage	Communication COM(2010) 265	analyse the effects of a policy which could reduce greenhouse gas emissions by 30 %; facilitate a more informed debate among stakeholders, on the repercussion of the 20% and 30% targets (seen from 2010's perspective) assess the risk of carbon leakage	Even if the Communication's conclusions supports the 30% commitment due to the economic growth that research and eco-innovation can bring to the EU economy, the impact is not clear since the international context is not favourable
All	Mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol	Decision No 280/2004/EC	set out the details for monitoring and reporting of greenhouse gas emissions by sources provide information of national programmes to reduce emissions, greenhouse gas emission projections and policies	Impact is unclear since current monitoring and reporting system needs to be improved
All	European Earth monitoring programme GMES (Global Monitoring for Environment and Security	COM (2005) 565	foundation for development of European Earth monitoring programme GMES (Global Monitoring for Environment and Security) collect up-to-date information on how the planet's climate is changing and how to improve the world citizens' security	(SPACE TEC Partners 2012) foresight that Copernicus will generate around 85 000 new jobs over the period 2015-2030 in downstream and upstream R&D and services, and that the societal benefits exceed four to twelve times its cost. In the transport sector can be used by policy makers on the development of new legislation, by public authorities on pollution control measures from road traffic and support ship routing services and accidents prevention, providing information of both currents and sea ice.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
All	Action Plan on Urban Mobility	Communication COM(2009) 490	set out a framework for EU initiatives in the area of urban mobility, while respecting the principle of subsidiarity encourage and support the development of sustainable urban mobility policies (for example through fostering the exchange of best practice and providing funding) to achieve the general EU objectives (Ex.:CIVITAS) propose an array of short and medium-term actions to be launched gradually until 2012 for dealing with urban mobility issues transform the city transport into environmentally sustainable and competitive while at the same time address the growing amount of social concerns provision of multiple interconnection points and efficient "last mile" freight and passenger transfer in urban transport grids.	Increased take-up actions related to urban sustainable urban mobility (urban freight, travel information, clean and energy-efficiency vehicles, internalisation of the external costs, pricing schemes, Intelligent Transport Systems, among others) and raised awareness of available funding from the Structural and Cohesion funds and the European Investment Bank for the take-up of sustainable urban mobility plans, including regional policies may contribute to the deployment of innovative urban transport solutions
All	Environmental Noise Directive	Directive 2002/49/EC	define a common approach across the EU for the assessment and management of environmental noise to reduce harmful effects require MS to appoint competent authorities to draw up "strategic noise maps" for major roads, railways, airports and agglomerations using harmonised noise indicators require MS to produce noise maps modelling noise exposure from which they shall develop subsequent action plans to tackle areas of high noise exposure and preserve quiet areas require the public to be informed and consulted about noise exposure regarding both effects and measures to address noise and develop long-term policies for noise reduction from source	The several phases of the Directive are still being conducted by MS, but have been several delays on implementation and reporting activities. A comprehensive and realistic impact assessment can only be obtained after a second round of noise mapping.
All	Strategy for a better internalisation of external costs of the transport industry	Communication COM (2008) 435	set a framework for a better internalisation of external costs across the several modes highlight the need for a more efficient transport pricing system that reflects its true costs	An evaluation shall be carried out but is expected that users by bearing the costs they create and will change their behaviour.
All	Marco Polo Programme	Regulation (EC) No 1382/2003	improve the intermodality, reduce road congestion and negative externalities of freight transport within the Community by shifting large cargo volumes from road to more environmentally friendly rail	Too slow a modal shift (only 46% of the modal shift goal was achieved) and difficulties to use the programme (companies consider the programme complex) may discourage companies from targeting the modal shift.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
			transport modes financial support (co-funding) to companies with viable projects to shift freight from roads to greener modes - railways, sea-routes and inland waterways	
Road	Information on the fuel consumption and CO2 emissions of new passenger cars	Directive (1999/94/EC)	Ensure that information relating to the fuel economy and CO2 emissions of new passenger cars offered for sale or lease in the Community is made available to consumers Enable consumers to make an informed choice, and change their behaviour concerning CO_2 emissions and encourages the industry to develop new technology	Studies could not conclude if the directive had a positive impact by itself, since there is a basket of legislation aiming to reduce CO_2 emissions.
Road	End-of-live vehicles Directive	Directive (2000/53/EC)	minimise the amount of waste from end-of-life vehicles, promote the reuse, recycling, and recovery of waste from ELVs, and make the vehicle dismantling and recycling more environmentally friendly set clear quantified targets for reuse, recycling and recovery of vehicles and their components restrict the use of hazardous substances in vehicles to prevent their release into the environment, facilitate recycling and avoid the disposal of hazardous waste promote the manufacturing of new vehicles with a view to their recyclability	Difficulties of MS to meet targets (several MS failed to meet their reuse/recycling/recovery targets in 2006, as reported in 2008) and implementation insufficiencies make it difficult to assess the impact of this Directive on the competitiveness of the European transport industry.
Road	Promotion of clean and energy-efficient road transport vehicles	Directive 2009/33/EC	introduce specific rules for public authorities and private operators with public service contracts to monetise environmental impacts (energy consumption, CO_2 and other pollutant emissions) over the whole lifetime of the vehicle in the purchasing decision of road vehicles promote a behavioural change on contractors, promoting the internalisation of environmental external costs in the long-run, promotion and deployment of cleaner-vehicles by the manufactures thru more rapid market penetration	Its implementation in a number of MS was considerably delayed and there are not yet reporting obligations that could allow an impact assessment. On the side of the procurers and the manufactures there is also no available data.
Road	Proposal for a Regulation on the sound level of motor vehicles	COM (2011) 856 final	ensure a high level of health and environmental protection, reducing the negative impact of noise exposure of European citizens caused by motor vehicle traffic, safeguarding also the internal	The industry will be exposed to additional costs due to initial investment needs which will be overweight by societal benefits. However on the long term, investments may level off and pay off, and standardisation may contribute to the development of new solutions.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
			market reduce traffic noise by around 25% modify and improve the applicable test methods and requirements within the European system for the type-approval of motor vehicles with regard to their noise emissions, based on international standards	
Road	Intermodal transport: combined transport of goods between Member States	Directive 92/106/EEC	improve intermodality by integrating rail, inland waterway and sea transport, and consequently reducing demand for road carriage allow MS to reduce or refund the motor vehicle taxes applicable to road vehicles routed in combined transport	The impacts cannot be assessed due to insufficient statistics and reporting structure for market monitoring. Some appointed deficiencies are ambiguity, lack of definitions and unclear fiscal incentives, being the measure not well exploited by MS
Waterborne	Ship-source pollution	Directive 2005/35/EC	incorporation into Community law of the Marpol Convention 73/78 on ship-source pollution harmonisation and creation of common rules on criminal penalties that facilitate effective cooperation and methods of investigation within and between MS	It has been severely criticised by the industry for its international law enlargement, but no negative impact assessment was found concerning competitiveness for the industry, since this Directive applies to all types of vessels irrespective of their flag
Waterborne	Introduction of Waterborne emissions on EU ETS scheme	Directive 2009/29/EC	allow the introduction of shipping industry emissions on EU ETS scheme, entering into force by 2013, if no international agreement will be reached by the International Maritime Organization (IMO)	Not implemented yet
Waterborne	Convention for the protection of the Mediterranean sea	Decision (2010/631/EC)	prevent and abate pollution from ships (and aircrafts) in the Mediterranean Sea define whose dumping are prohibited, and whose are allowed after an assessment of the competent national authorities promote cooperation in preventing pollution from ships and, in cases of emergency, combating pollution of the Mediterranean Sea.	Its implementation has experienced several delays and problems for several reasons including lack of ratification and poor financial resources. So it is difficult to assess its impact
Waterborne	Proposal for a Regulation of ship recycling	Communication COM (2012) 118	significantly reduce the negative impacts linked to the recycling of EU-flagged ships, especially in South Asia without creating unnecessary economic burdens bring into force an early implementation of the requirements of the Hong Kong Convention, aiming to speeding up its entry into force globally	Generally it may improve previous unsuccessful legislation and specifically, by avoiding additional economic burdens, new proposed legislation may promote better industry practices without jeopardising companies' financial situation
Air	**Noise-management at EU airports** - Promote	Directive (2002/30/EC)	promote the development of airport capacity in harmony with the environment, limiting or reducing the number of people significantly	This EU Directive is under amending process but a consultations with stakeholders revealed that some kind of distorted competition may emerge and that measures had a limited impact on noise reduction.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
	the sustainable development of air transport through the reduction of noise pollution from aircraft at the most exposed airports		affected by the harmful effects of noise in the most cost-effective manner, safeguarding internal market requirements; allow more stringent noise standards, to be imposed only at the most noise-sensitive airports (those with more than 50 000 movements per year and city airports), by a series of operating restrictions, including the gradual withdrawal of the noisiest aircraft.	
Air	Clean Sky Joint Technology Initiative	Regulation (EC) No 71/2007	speed up technological developments that will allow cleaner solutions for air transportation coordinate aeronautics research on a European scale, accelerate the development of clean air transport technologies, develop knowledge generation and its application and set a competitive air transport system reduce CO2 emissions by 50%, NOx by 80% and noise by 50%, until 2020	A formal assessment of Clean Sky achievements is not yet available. Yet, there are positive indications which give confidence that Clean Sky should meet its objectives substantially enhancing the competitiveness of the European transport industry.
Air	Includes aviation activities in the scheme for GHG emission allowance trading within the Community	Directive 2008/101/EC	reduce the climate change impact attributable to aviation encourage the development of new technologies	Not implemented yet, but experts do not anticipating a strong impact of this measure neither on emissions reduction on the short-medium-term nor on developing of fuel efficient aircraft due to the relative more relevance of fuel and aircraft costs.
Rail	Rail noise abatement measures addressing the existing fleet	COM(2008) 432 final	reduce the exposure of citizens to rail noise emissions by up to 50% without jeopardising the competitiveness of rail freight, by promoting rail noise abatement programmes to curb noise emissions of freight trains mainly by retrofitting freight wagons with low-noise brakes give priority to retrofitting wagons with a high yearly mileage to maximise noise reduction at an early stage.	The impacts of noise abatement legislation and measures are not consensual. It may impose financial burden on the rail industry and experience a loss in market shares against road. But research may help the industry saving money and establishing EU wide common and binding noise levels may provide the European rail industry with some comparative advantage against external markets derived from increased research and innovation.

6. Security policy (ICTAF)

Terror attacks like 9/11 and the rail catastrophe in Madrid demonstrated the vulnerability of the open transport systems to damage of people, goods, property and the entire society. Today more than ever transport systems are attractive targets for terrorists seeking to inflict mass casualties, huge economic damages, instill fear and create spectacular media imagery. But threats to transportation security do not limit themselves to terrorist attacks only. Theft crimes and natural disasters also generate economic and social losses encompassing cargo damage, breakdowns of transport infrastructure and supply operations, but also reputational damage, loss customer trust and personnel harms, and long-lasting economic losses. These harms, coupled with other risks, prodded the EC to implement security measures to pre-empt, neutralise and/or deal with the various post-disaster repercussion such and safeguarding people, industrial installations and societal functioning.

The Transportation Research Board (Edwards and Goodrich 2013) identified four objectives for transportation security: deter, detect, deny and mitigate. Nations try to attain these objectives, although perfect security is impossible. Since public interest approach holds that government intervention ameliorates market failures and information asymmetries (Joscow and Rose 1989), we may expect that changes in transportation security regulations may affect competitiveness of European transport industry. By adding additional security requirements, these regulations may enhance the production and the operational costs, and thus reduce the European transport equipment competitiveness in the short run. Yet, since security of passenger goods and private and public property is a must in any national settings, more secure transport equipment and systems may win in rivalry with the less safe ones.

According to economic theory, the government market regulation should prompt firms to compete in ways that benefit the consumers but also allows them to earn at least marginal profit. Since we know very little about the nature of competition in the absence of regulation and in global markets with different types of legal law codes, the assessment of impacts of the EC security policy will focus on possible consequences for production and supply costs in Europe, only some implications for the global competitive standing.

The studies of competition are hampered by the scarcity of data and, in particular, by the lack of good indicators of changes in competitive positions of industrial operators as a result of their regulatory compliance. Researchers and policy-makers usually rely on traditional measures like the price cost-margin (PCM) to assess competitiveness levels of different industries. However, theoretical research raises doubts as regards the robustness of PCM. Several researches (Amir and Lazzati 2011), (Burlow and Paul 2002) and (Rosenthal 1980) show, that there are theoretically possible scenarios in which PCM increases even under condition of more intense competition.

With respect to competition in network industries, two aspects appear especially important: market power and potential competitors. Security is a global public good rather than an object of national welfare. Stiglitz (1995) has identified five global public goods and one of them is International Security Environment. The international scale of competition among providers of transportation equipment, systems and services is determined by the pricing and quality of supplies. (Bruck 2005)

explains how the state of insecurity imposes social, political and economic costs. First, there are direct costs from the security threats; second, there are costs from the agent's reaction to these threats; and finally, there are costs caused by implementation of security regulations. Indeed, government security regulation can affect the national economies, but also the competitive positions of individual companies. Hobijn (2002) and Lenain, Bonturi and Koen (2002), state that the standard governmental security regulations related to national defence, fighting crime and protecting civil rights tend to impose additional costs on business. Those costs can reduce the firms' efficiency, hurt small enterprises and increase market power of large corporations. Insecurity, on the other hand may impose even higher and long-lasting costs arising from crises that involve losses of human life, property, industrial installations and infrastructure damage.

Therefore, the attainment of a global public good such as security requires international coordination. Kunreuther and Heal (2003) show that if firms are subjected to diverse security regulations, the expected losses from the lack of security might be higher than when they face the harmonised regulations. Developing, implementing and enforcing common European security legislation may thus reduce additional costs related to the lack of security even if it invokes compliance costs. However, when such policies differ from the extra-EU countries they might either impose extra costs on European suppliers or give them a competitive boost. That's why the EC seeks to coordinate industrial standards with the extra EU partners, as pointed out in the Commission's Staff Working document on transport security (EC 2012 j).

In order to understand the impact of security regulation on business in Europe, we will explain the connection between these two parameters through an example. What could happen if there was a 100% scanning obligation on all goods that enter the EU market? The imposition of 100% scanning will create huge economic costs. First, there will be direct transport-related costs imposed on cargo service providers that will ultimately be paid by consumers. Secondly, there will be indirect costs resulting from functional disruptions of global and international supply chains. In addition, the end impacts of 100% scanning rule on ports and terminals will also depend on the specific lay-out and the level of technical endowment of these facilities and their operations pattern. Some ports and terminals consider that the 100% scanning will not upset much their operations, whilst others see it as completely unworkable and highly detrimental to efficient and effective utilization of production facilities. Thus, some ports and terminals can organize the total scanning without creating major impediments or delays, while others may face major cost-enhancement problems. Universal implementation of security requirements imposed by this legislation would put all ports on equal level playing ground with regards to security, but the targets might struggle to practically adhere to this law.

6.1 Main security related polices

Security in a transport sector seeks to prevent acts of unlawful interference against passengers, freight or transport infrastructure and other public and private transport-related property. Security should give users confidence that they can use transport. There are several reasons why transport security is not as advanced in the EU as it could be (EC 2012 j). The transport sector security measures may dither customers and passengers trust in the service offerings. Therefore, security

can be perceived by some in the transport industry as an extra cost, or even being the entire responsibility the state, and thus should be financed from the government-collected taxes. Therefore, mandatory increases in security requirements in transport often occur reactively in the aftermath of catastrophic events and/or disasters.

The extension of the European Single Market by the Schengen Rules which removed border controls within the European Union was beneficial for citizens and the economy. At the same time, however, it has not been accompanied by significant efforts to deal with enhanced risks of malicious actions, economic criminality and wild migration. Also, the attitude towards such risks varies considerably throughout the EU. Protecting against terrorist risks costs money. Large companies have, to some extent, implemented some security measures for shielding their own property and supply chains. However, a majority of medium and small companies, including their employees neither have implemented the required security measures nor are fully aware of the risks they are exposed to. The EU-wide security measures can become effective only when they take into account the interdependency between all companies within a given supply chain and/or value chain and standardise security standards at the system level.

6.1.1 Formal Legislation

Air Security Legislation

Since 2008 all regulations sought to make the air security legislation quite similar to the worldwide standards. Those standards are intended to ensure fair competition between airlines within the EU and worldwide. However, the Regulation (EC) 1254/2009 allows member states to derogate from the common basic standards on civil aviation security and adopt alternative security measures which must, however, provide adequate level of protection as judged by the local risk assessment. Such alternative measures should be put in place according to criteria justified by the size of the aircraft or by the nature, scale or frequency of operations or other relevant activities.

Within the air transport we can distinguish between the framework legislation, the supplementing and implementation regulations, all of which are of binding nature.

Framework Regulations

- Regulation (EC) No 2320/2002 - Applies common rules in the field of civil aviation security across all Member States. Based on the recommendations of ECAC the three main objectives of the regulation are to:
- Establish and implement appropriate community measures, in order to prevent acts of unlawful interference against civil aviation.
- Provide basis for common interpretation of related provisions of Chicago convention, in particular its Annex 17 which is considered to be the rulebook of aviation security, and details what is required to produce a valid national aviation security program.
- Include detailed the following subject rules to the community laws, airport security, aircraft security, screening and protection methods, staff recruitment, and training and equipment standards.

- Regulation (EC) 300/2008 - Eliminates and replaces the 2002 regulation. The main changes include that each member state must establish a national security program for civil aviation and designate a single authority responsible for the coordination and monitoring of the implementation of security standards. Each member state must also establish a national quality control programme for civil aviation security and each airport operator, air carrier and any other body responsible for applying security standards must also draw up a security programme.

Supplementing Regulations

- Regulation (EC) 272/2009 - Supplementing the common basic standards on civil aviation security laid down in the Annex to Regulation (EC) No 300/2008 of the European Parliament and the Council. Regulation (EC) 272/2009 may allow methods of screening, individually or in combination, as a primary or secondary means of security maintenance under defined conditions. Some examples of such methods include the manual search, walk-through metal detection, hand-held metal detection, explosive detection dogs and explosive trace detection. This regulation is meant to improve passengers' trust in the security of air transportation.
- Regulation (EC) 1254/2009 – Sets out criteria allowing member states to derogate from the common basic standards on civil aviation security and adopt alternative security measures.
- Regulation (EU) 18/2010 – amends Regulation (EC) No 300/2008 and introduces common specifications with regards to the types of power that the national authorities wield as regards monitoring and enforcing the national quality control programme to be implemented by each MS in the field of civil aviation security and the elements of which such programme shall include in order to sufficiently monitor the effectiveness, implementation and compliance level with security measures.

Implementing Regulations

- Regulation (EC) 72/2010 – Lies down procedures for conducting commission inspections in the field of aviation security.
- Regulation (EC) 185/2010 - Lies down detailed measures for the implementation of the common basic standards on aviation security.

A proposal - (COM (2009) 217) - for a Directive on aviation security charges has also been developed by the Commission of the European Communities to "set common principles for the levying of security charges at Community airports" (EC 2009/C217) that uniforms the current disparity between the national systems and creates a fair playing ground for competition. Besides, EU aviation security policy is to take account of requirements set down by the European Civil Aviation Conference, the European Union and the International Civil Aviation Organization.

Maritime Security Legislation

In addition to public financing support to maritime transportation, the EC has introduced new measures to protect its security. The first response to the increased risk of terror attacks after 9/11 came from the IMO (International Maritime Organization), a UN body responsible for developing

common regulatory framework for international maritime transport. In December 2002, a number of amendments to the 1974 Safety of Life at Sea Convention (SOLAS) were introduced and became effective at international level on the 1st July 2004 (Papa 2013).

Also in December 2002 the IMO Diplomatic Conference adopted the International Ship and Port Facility Security (ISPS) Code. This Code comprises maritime security regulations in order to address measures against terrorist activities. The European Union fully agreed with its contents.

Regulation (EC) No 725/2004 - enhancing ship and ports security, aims at establishing an international framework for ships and ports to cooperate against the acts which may threaten maritime security. The EC takes it a step forward by making certain provisions in the part B of the ISPS Code mandatory, in order to enhance the level of security and at the same time, facilitate a its homogeneous interpretation among the Member States.

A year later, a Directive 2005/65/EC was adopted to enhance security of EU ports by introducing a set of common measures as well mechanisms to implement and monitor compliance in order to create a comparable level framework for security standards across all European ports. MS should set up the necessary binding legislation and informal policies to comply with this law within June 2007.

Other Security Legislation

Strictly said, and according to the EC staff working document on transport security (EC 2012 j), no binding security requirements exist either for railways or roads. However, some safety and interoperability related legislation may be mentioned here. Since the national rail networks in Europe differ as regards the technical conditions of infrastructure, it is both difficult and costly to run non-stop trains from one country to another. Therefore, the Directive 2001/16/EC promotes interoperability and provides measures to overcome technical divergences in infrastructure, signalling systems,, traffic management and rolling stock.

Furthermore, Directive 2004/49/EC, adopted as part of the second railway package, put into place a harmonized framework and approach to rail safety and also defined the roles and responsibilities of

- Railway undertakings and infrastructure managers.
- Member States for establishing the national safety authorities who are responsible for administering and managing some of the safety provisions described there.
- The accident investigation bodies which shall be established by each MS to carry out investigations in order to identify accidents cause and background.

The directive foresees the development of harmonized technical safety measures, such as common safety targets and common safety methods, and links the safety and security management of railways with the harmonised technical requirements defined as TSIs (EC 2007). When implemented, one of the possible impacts of this directive is reduction of probability of security endangering acts.

No specific security binding legislation for transport of goods and persons on roads could be found. However, there is a security-related legislation that pertains to all transport modes such as Regulation (EC) No 1875/2006 on increasing the security of shipments entering or leaving the EU. Among other issues, this Regulation specifies requirements for who shall hold the responsibility to lodge the entry summary, the deadlines for doing so and also the locations for entry summary.

6.1.2 Informal legislation, research and joint activities

Informal policies are important for enhancing transport security. A security incident somewhere in the world can cause business disruptions anywhere else either along the supply chain or in transport service networks. Thus, it is necessary to address transport security from a global perspective. But, since there is a lack of global binding legislation, cooperation between countries is essential to reach voluntary agreements, develop international standards and exchange knowledge, information and best-practices, which also can contribute to:

- Development of high-security systems to reduce transport vulnerability towards incidents by m improving the positioning of cargo ships and networks surveillance while securing the confidentiality of data, and identifying security risks.
- Improve access to emergency services that can at least reduce the physical and personal losses.
- Facilitate seamless cross-border procedures and customs through more efficient and reliable control systems to improve efficiency and performance of freight and logistics services, facilitate intermodal transport of goods and passengers, and reduce the costs related to administrative burdens, standard compliance and other requirements.
- Adapt to evolving threats deriving from new terrorists' weapons, the increasing preponderance of natural hazards and crimes derived from higher environmental pressures and social inequality.

There is another reason for which informal policies are essential for transport security. They may foster integration of the industry and its stakeholders. They may also support agreements on standards that give manufacturers and services providers the necessary certainty before (at least) considering making some investments. As shown in the preceding and following chapters, several ETP have been developed with an aim to integrate interests, identify key research areas and gather financial, human and administrative resources to foster new transport solutions, safety, new technologies, and energy efficiency. However no such platform seems to exist with regards to transport security.

6.2 Impacts on transportation by sectors

6.2.1 Aviation

Over the last 20 years many companies in the European air transport industry went through privatization as a consequence of which the air industry evolved from the state owned carriers to a dynamic free market industry, although national flag carriers still constitute a sizable number of

operators in European and global aerospace.

By early 1970s the evidence started to accumulate in the US that regulation of infrastructure-dependent industries had negative consequences such as low effectiveness and low innovation proclivity. Therefore, in 1978 the US started to deregulate its air travel industry. Economists were surprised by the positive effects of deregulation. Deregulation led also to reconsideration of the international and bilateral inter-country agreements. The European authorities followed the US and began deregulation of European air travel industry about ten years later. The full deregulation of the European air travel industry took place at 1997, after the three liberalisation policy packages have been adopted. The first was adopted in December 1987, the second in July 1990, and the third in Jun 1992. These three policy packages removed restrictions on market entry, capacity and pricing of the air travel service. On 30 March 2008, The Open-Skies agreement went into effect. Now European airlines can fly without any restrictions from any point in the EU to the US. The new agreement is expected to increase competition and reduce airfares in the international air transport market. Some other elements of the agreement are fostering cooperation in fields such as security, safety and environment. The deregulation opened great opportunities for the existing and new airlines. Generally new airlines entered with 30-40% lower costs than the incumbents, largely driven by the low non-union labour costs and wide variety of inexpensive second-hand aircrafts, forcing the existing companies to reduce their operating costs.

As in any transport industry, also in aviation there is a positive relationship between the companies' wealth and the occurrence of security incidents. The link between security incidents and a company's wealth can be either positive or negative - negative because of the direct costs derived from incidents and/or introduction of costly measures to avoid similar events, both of which decrease the company's wealth, and positive because adoption of such measures, although costly in a short-term can save a given company from a lot of future troubles. This link could be explained through the air travel terrorist attack on September 11th, 2001. The world airline industry was shaken which led the US civil aviation authorities to close the nation's airspace for several days. After that the security level at all US airports was considerably hiked also increasing the operations and reputational costs of the entire industry. More security measures lengthen waiting time making the air transportation less cost-effective and efficient. Since the 9/11 terrorist attack, the security of air passengers and cargo became a major concern in many countries, including the EU. Traffic within Europe fell by over 10% in September and October 2001, while traffic from Europe to the US and Asia fell by 35% and 17% respectively. However, such increases in security level might have also prevented other incidents, saving the airlines and the aviation regulators lots of money. Of course the problem is that we cannot measure those savings directly, although the calculation of expected costs in the case such accidents happened again would be possible through an inversive analytical approach.

Security incidents do happen occasionally. As regulations are often launched in response to calamitous events, severe security breaches impose significant costs on the entire air transport industry and its users. In order to avoid revenues loss, loss of passenger lives and threats to wellbeing, airline companies spend millions of Euros on security equipment and training of security staff. How companies face such costs also depends on the regulatory framework, which is not

necessarily connected to security threats. For instance, Article 107 of the EU Treaty laid down strict regulation on state aid in order to prevent countries from supporting their national airlines. After the 9/11 attacks the US government provided subsidies to large parts of the US airline industry. The EC hasn't subsidised any airline, apart from compensating them for the revenue loss directly related to the attack. The research by Borenstein and Zimmerman (1988) and Mitchell and Maloney (1989) has found out that the equity value of an airline suffering a fatal crash was dramatically reduced rendering abnormally negative returns. Therefore, it is possible that the airline companies which don't have enough financial strength to deal with security challenges through new investments in appropriate technologies could be financially weakened and become less competitive than their American counterparts. Needless to say, such investments affect not only the passenger transport service but also, the air freight forwarders and logistic companies offering air cargo services.

Since the 9/11 attack the EU has radically changed its security regulations throughout the supply chain. The security rules enacted by the EC for cargo and mail protection have considerable global economic impacts. Until July 2003, shipper's security arrangements could be assessed by air cargo agents. If an agent found that the shipper was in accordance with the required standards, it was possible to validate the shipment status by awarding it the 'known consignor' tag. However, two incidents - the uncovering of a huge arms haul in 13 maritime containers at the port of Lagos and two explosive devices that came from Yemen shipped as harmless cargo on passenger aircraft - brought the question of supply chain security sharply back into focus (Raynolds n.d.). Therefore, since 2003 the EU has developed a robust air cargo and mail security regime where all cargo and mail are physically screened (DG Mobility and Transport 2013). The Screening Act will reduce the risk from unexpected terror incidents and other unsocial actions. This security policy was implemented as response to the above incidents, and in turn, affected operations of transport supply and the entire industry and, ultimately, the way the service provision will evolve in the future. Speakers at the Secure Freight Forum held at IATA's offices in Geneva in 2013 noted that nearly 50 million tons of cargo, equivalent to 5.3 trillion dollar is transported by air each year. Governments and industry share the goal of keeping the air cargo secure. This provides common ground for closer cooperation, harmonization of regulation, global capacity building and the long-term commitments to regulation implementation (IATA 2013).

Assessing the impacts that each security regulation invokes on competitiveness of European transport industry is quite difficult because we are still far away from knowing all costs and benefits of security measures. Of particular difficulty is estimation of costs associated with the effects of security on system functionality (Jackson et al. 2012b) and needs for additional spending associated with compliance with security regulations. The question is who pays for aviation security? In the EU, it varies by country, but the burden is mostly imposed on airlines, airports and passengers. Some examples are y reviewed below (Poole 2009).

> In the United Kingdom, the major airports are responsible for all airport security, at their own expense. These costs get factored into the cost base on which they charge airlines for airside and landside services.

Germany has a federal aviation security tax which is added to airline tickets, but that tax covers only a portion of the capital and operating costs of airport security, the balance of which is paid from the airport budgets. Some German airports have been privatized, while others remain owned by a combination of state and municipalities. Thus, the sources from which the aviation security costs in Europe are covered seem to be the passenger taxes and airport costs, with the latter being absorbed by airline charges, which again are integrated into air fares paid by passengers and freight shippers. This indicates that the ultimate security cost bearers are the air transport users.

The outcomes of consultation conducted for the new Directive proposal on aviation security charges (COM (2009) 217)) reflect very well the lack of consensus on the previously formulated question on who pays for the aviation security: "All industry organisations emphasised that aviation security is a state responsibility and the costs should therefore be borne by the states. However, no Member State was in favour of an obligation for it to cover security costs". (EC 2009/C217)

Figure 9 implies that a multitude of security measures should be taken into consideration in order to ensure passenger security. The airline industry believes that the EC legislation on security charges must improve the transparency of security costs and also help to reduce security costs for passengers and shippers by delimiting responsibility to cover such costs by each party in the aviation service system: infrastructure providers, airport mangers, airlines, manufacturers of aircraft and auxiliary navigation systems, passengers, freight shippers and forwarders. It will allow for more consultation between the airport operators and help to make the implementation of aviation security measures more effective.

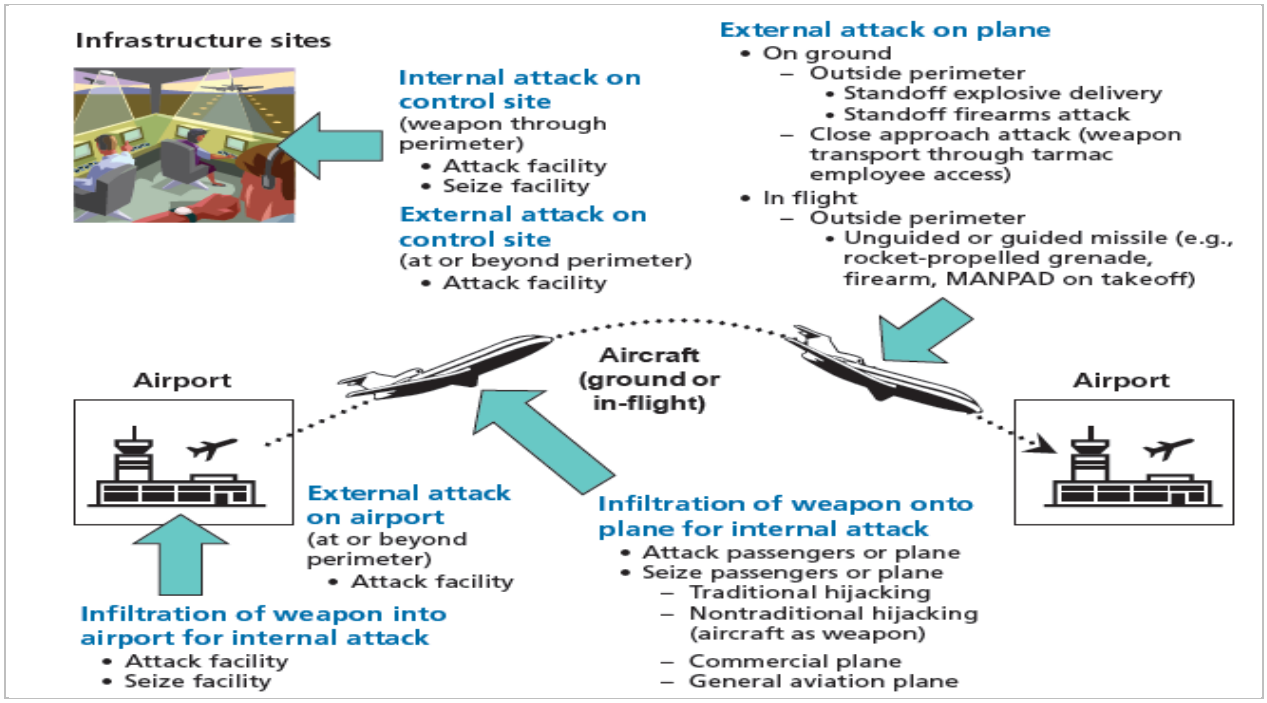


Figure 10: Classes of attacks on aviation system (Source: RAND Database of Worldwide Terrorism Incident)

The competition playing ground between airlines may be negatively skewed toward those who choose to invest less in security-enhancing measures, and thereby reduce their operations costs and airfares. However, this may only be the case as long as incidents do not occur. In case they do, the consequences of not making necessary investments to improve security conditions could be fatal for the passenger, operators and the entire industry.

6.2.2 Maritime transportation

The marine transportation system is a network of specialized vessels and ports they visit. Maritime transportation is a necessary complement to and an occasional substitute for other modes of freight transportation. However, to reach many overseas destinations, there is no direct substitute for waterborne transportation. The other important marine transportation activities include passenger maritime carriage (ferries and cruise ships), national defence (naval vessels), fishing and marine resource extraction, and navigational service (vessel-assist tugs, harbour maintenance vessels).

Maritime security incidents are international. They involve damage to all parties to the maritime chains. Maritime piracy incidents are also international but unlike maritime security incidents their purpose is theft and might not have as serious consequences for the entire industry as the terror acts and maritime crimes do. When it comes to security incidents at ports, we can divide ports reactions to tackle them into four phases:

Prevention – creating barriers that prevent terrorists from planning and undertaking attacks.
Detection – early apprehension of planned incident.
Response – mitigation of the impact of the security incident once it occurred.
Recovery – the port seeks to return to normal operation following a security incident.

Those four phases should be included in every port's business plan, in order to reduce the probability for security incident. Maritime supply chains are susceptible to terrorism given that they are important for international trade. As the EU trade with overseas destinations has increased over the last years considerably (Figure 2), any disruptions in maritime supply chains attributable to breach of maritime security can have very negative and lasting consequences for the EC entire economy.

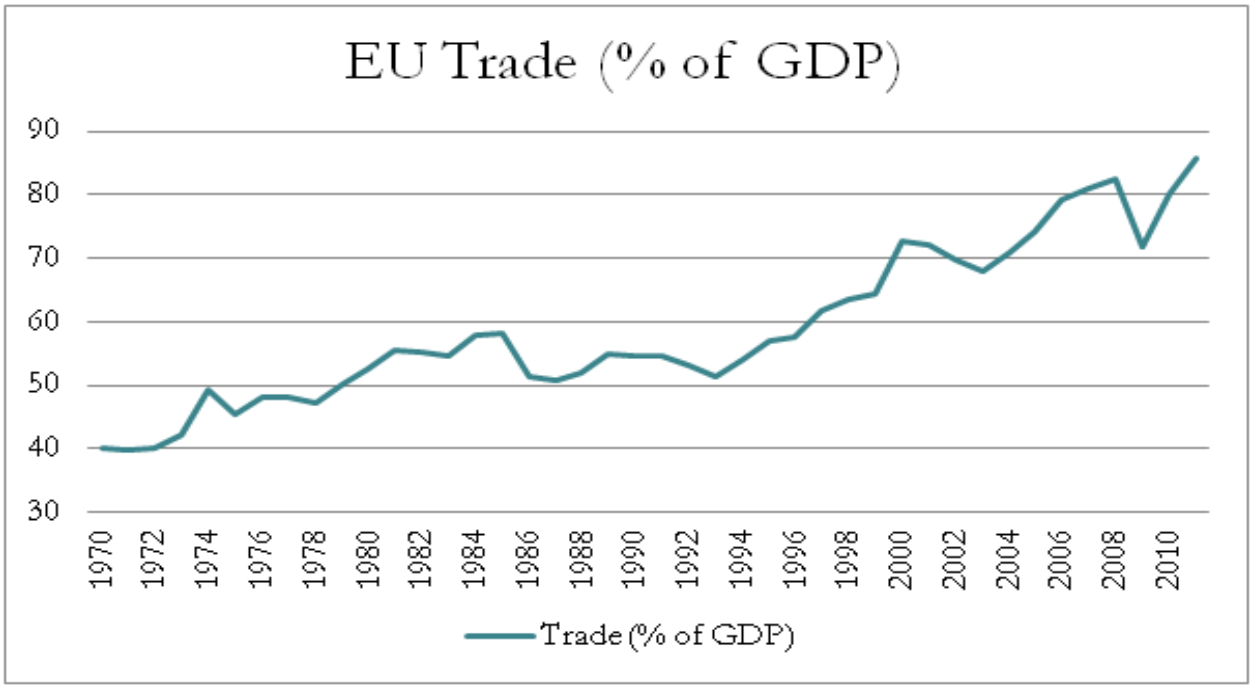


Figure 11: Development of EU Trade (%GDP) (Source: World Bank)

The main factors that explain the increase in trade is the progressive dismantling of national trade barriers which has taken place since the WW 2. Yet, despite the decline of trade restrictions, there are still some trade inhibiting factors such as poor hinterland connections and the lack of sufficient finance, especially as a consequence of considerable decline in demand for maritime tonnage caused by the current economic crisis. Geographical distance between trading partners should not be considered as a cost because it provides basis for international trade. However, all other determinants of transportation costs can be influenced by operators, governments, shippers, and the maritime equipment and systems providers. In addition, development of necessary infrastructure to relief congestion at gateway ports and along hinterland transfer, as well as informal policies such as PPP may also reduce the maritime transport costs and the cargo protection outlays.

After the 9/11 terrorist attack there was a stark global increase in public and private expenditures on security measures globally, and also in Europe. It is implicitly assumed that the applied security measures reduce these risks (Viscusi and Zeckhauser 2005). The cost-benefit analyses (CBA) of security measures could assess the costs of such measures against the benefits gained by risk reduction. It is, however, acknowledged that the standard cost-benefit analysis has difficulty with assessment of security measures because the likelihood and consequences of terrorist impacts, and thus the benefits of security enhancement, are hard to quantify (Richardson et al. 2005; Robinson et al. 2010).

Security of maritime transport is not only threatened by terrorist attacks. Incidents caused by technical failures such as oil spills and natural disasters also affect the maritime industry, the welfare of Europeans and other industries closely related to transport such as tourism. The EU has a coastline of 68,000 km. Almost half of the EU's population lives less than 50 km from the sea. The sea is Europe's most popular holiday destination. Economic assets located within 500 meters from the sea line have an estimated value between € 500–1,000 billion, and the EU public expenditure on

coastline protection from the risks of erosion and flooding is expected to reach € 5.4 billion per year for the period 1990–2020, (Christiansen 2010).

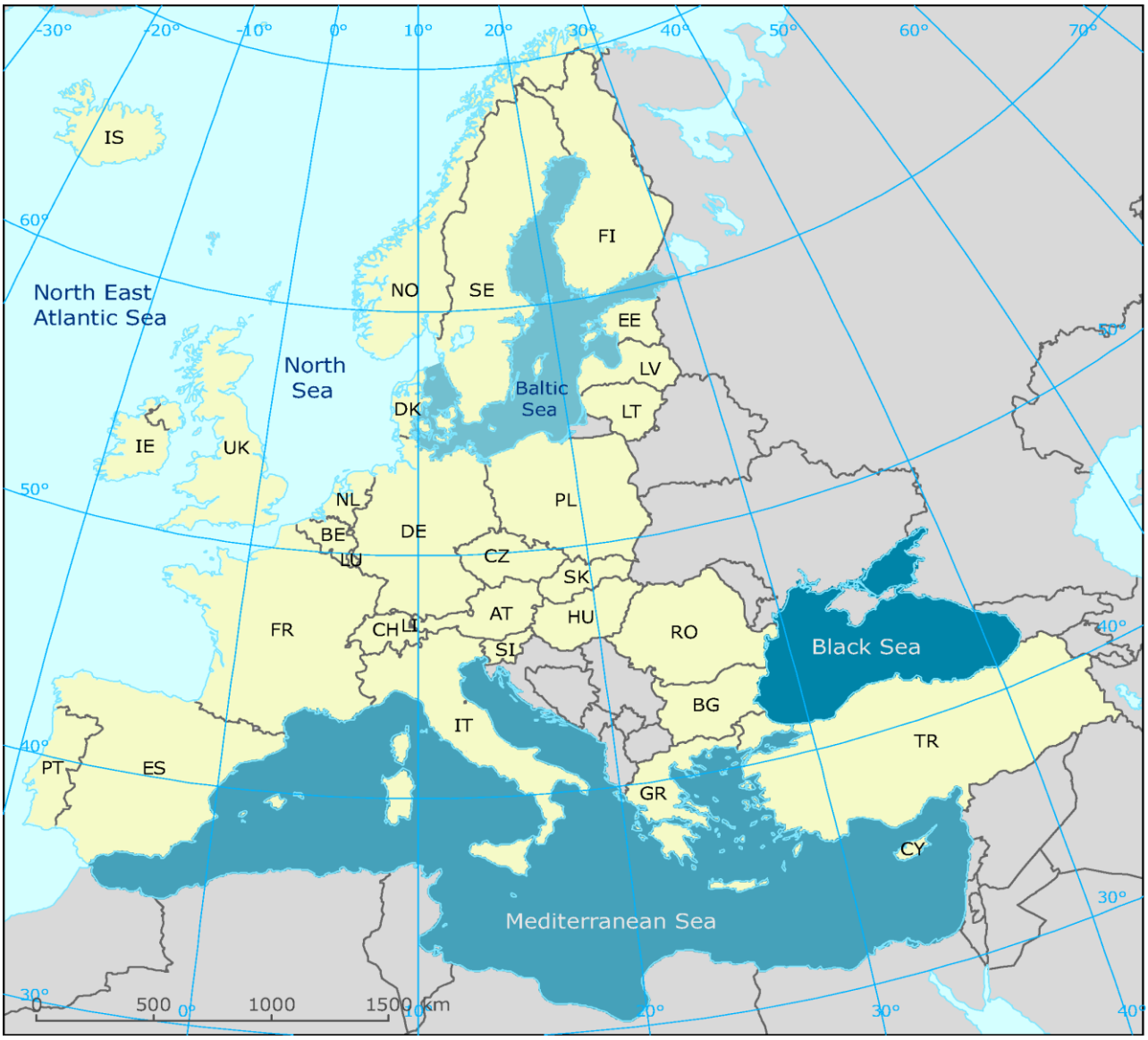


Figure 12: EU's regional seas

Maritime regulations impose international security certificates on all operational ships and port facilities to be issued by governments as a proof of their sufficient compliance with the ISPS Code. In order to meet the minimum required level of compliance, the port facilities and the shipping companies have to implement technical as well as organizational measures that will increase operations costs at ports facilities and for European maritime industry. One study (Dekker and Stevens 2007) has established that the average investment cost related to implementation of security regulations in 2004 was about € 464,000 per port facility, and the average running cost was about € 234,000 per annum. Another study (Rotterdam Maritime Group 2004) indicates that port facilities and shipping companies have found on their own how to cover their additional security costs. The UNCTAD'S Review of Maritime Transportation for 2012 (UNCTAD 2012) reveals that the average cost of shipping a 20-foot equivalent unit (TEU) container from Shanghai to Northern Europe fell from $1,789 in 2010 to $881 in 2011, while the average rate for shipping a 40-foot equivalent unit (FEU) container from Shanghai to the West Coast of the United States declined during the same

period from $2,308 to $1,667. The average size of the largest container ships increased during the same period by 11.5%. Between 2004 and 2011, the average number of liner companies dropped by nearly 23 per cent, while the size of the largest deployed ships has nearly doubled. According to the UNCTAD'S Review, a trend featuring increasing containership sizes was a response to high spikes in bunker prices, sharp decline of tonnage shipped and rates, and enhanced competition on main lane trades. As a consequence the restructuring of the industry has now continued over several years.

How can these changes affect the European competitiveness? Presumably, as the security standards increase and as the differences between security regulations across the globe decrease, these trends will not impose any high additional costs on shippers, logistics operators, shipping lines and the ports. Some companies and ports which struggle for financial survival can go bankrupt when trying to implement security regulations. We can conclude that if companies and ports will not get subsidy and/or improve their technology in order to reduce costs, one possible effect may be that these operators will not be in position to offer high-quality service, including the sufficient cargo and passenger protection.

A EC assessment report (EC 2009/C2) on the implementation of Directive 2005/65/EC launched in 2009 showed that although the MS had incorporated the Directive provisions into national legislations, some organisational and functional difficulties (specially with regards to the definition of a port perimeter) prevented the local port administrations from practically implementing these measures. But the assessment concluded that it was too early to assess the impact of this Directive and that the MS should continue their efforts to complete transposition because of the relevance of the security level at ports for the cargo moved, the logistics operators and the passengers.

6.2.3 Road

When we are talking about road security regulations we mostly refer to the safety standards of the vehicles and not an anti-terrorist legislation seeking to avert and/or mitigate the impacts of different hazards. However, security threats to European roads have become a growing concern, as vehicles and cargo are increasingly exploited for criminal activities. The reason why road transport represents an alluring choice for criminals or terrorists is that a large percentage of trucks carry hazardous freight which is susceptible to concealing the barred items. Member States are currently responsible for controlling their own borders, and therefore, all security-related matters mainly fall under their national jurisdictions. With those developments the European Commission has acknowledged that the rules underpinning common European Security Environment may need to be better prepared to confront the security threats. The European Commission has launched several security programs such as (EC 2012 j):

- Secure lorry parking – EU-wide eCall system providing a direct link to emergency services to lorry drivers and thus enhancing their personal security as well as that of their cargo.
- SERON (Security of road transport networks) – focus on the development of a methodology which is to help owners and operators to analyze critical road transport networks or their parts with regard to possible terrorist attacks.

- The Electronic Customs Project – "aims to replace the paper format of customs procedures with the EU-wide electronic system, thus creating a more efficient and modern customs environment. The project's dual objective is to enhance security at the EU's external borders and facilitate trade. It should therefore benefit both the business and the citizens" (EC 2013 h).

The goods moving along a supply chain switch a lot of "hands" until they arrive at final destination. For these reasons, prior knowledge of the type of goods to arrive at the border has become an imperative in the recent years. Firstly, there is a growing responsibility put upon border agencies and customs in particular to facilitate international trade by speeding up and simplifying the border clearance. Secondly, there is a need to screen the goods ahead of arrival. In the wake of the 9/11 events there has been a growing concern that supply chains are exposed to terrorist threats, and/or that logistics' conduits could be used to fuel terrorist activities. Therefore, if customs and other border agencies will receive prior information about the cargo, and if this information will be 100% truthful, they could avoid the different kind of risks, like bomb packages and other terror acts.

Several EU programs and other policy measures for road transport are intended to promote efficient road freight and passengers transport, create fair conditions for competition, introduce and harmonize safer and more environmentally friendly technical standards, ensure fiscal and social harmonization, and secure that the road transport rules are applied effectively and without discrimination. If implemented, these programmes might make the European road transport industry much safer, more secure and more efficient. However, in parallel to the maritime transport environment, the implementation of these policy packages and measures by the Member States is still lagging because of relatively high compliance costs and demand for new investments in ICT based information exchange systems.

6.2.4 Rail

Towards the end of the 20th century, most of the developed countries have adopted radical reforms to strengthen their railway systems. The relation between the state and the markets in governing the railroad industry has already had a long and controversial history in Europe (Knieps 2012). European Rail transport has been declining for the last several decades, especially in freight. The share of rail in the freight land transport market decreased from 32.6 % in 1970 to just 16.7 % in 2006. In absolute terms rail freight transport activity declined between 1970 and 2006 by about 1%. However, freight transport by road more than tripled in this period (EC 2008 b). The rail industry has struggled until recently in terms of passenger shares. This situation has improved after opening of high speed rail lines.

Since 9/11, the rail and road transportation have been targeted by terrorists. In order to be able compete in the market the security of production and supply operations is essential for every firm. The European railway network is an open system badly protected against malicious actions and natural hazards. The rail transport industry maximizes its utility function by trying to increase passenger carrying capacity, whereas one of the government's aim is to protect the citizens and national property. Therefore governments have to impose different security regulations on rail

industry which may increase the costs of operations and require new investments.

There is only one European passenger rail service where the security needs resemble that at an airport. Since the opening of the Channel Tunnel between France and United Kingdom, rail passengers on the Eurostar have been subjected to security screening. Passengers using high speed rail services in Spain are also subject to security screening but this is less extensive.
Most rail security within Europe focuses on preventing criminal rather than terrorist threats. However, it is important to note that there have been several significant attacks against rail targets (Lieberman and Bucht 2009):

- August 10, 2001 attack in Angola, which killed over 250 people.
- March 11, 2004 attack in Madrid (over 190 people killed).
- July 7, 2005 attack in London, which killed over 50 people.
- July 11, 2006 attack in Mumbai (over 180 people killed).
- February 17, 2007 attack on Samjhauta Express, a train travelling from India to Pakistan that killed over 60 people.

In fact, it has been pointed out that "Rail attacks are more numerous and deadly than those on airports and airplanes…" (Riley 2004). But despite economic importance of rail infrastructure and the evidence that rail attacks can kill significant numbers of people, investments in protecting rail travel have been much lower than in air travel and the amount of research devoted to studying what makes rail attacks more likely is quite limited (Asal, Deloughery and Mabrey 2012).

As long as governments will put into force more security regulations, fewer companies will exploit poor safety and security standards for gaining competitive edge. Therefore, we may say that security measures and procedures similar to those already adopted in the air and marine transport will be needed for railways as well. Higher security standards will probably impose extra costs on companies in rail transport. Consequently, those that are struggling for financial survival may go bankrupt while trying to implement the required regulations. If companies will not get subsidy and/or improve their technology in order to reduce these costs, probably fewer companies will be able to protect their own property and personnel, and offer services which adequately shield the cargo and passenger transfer. However, since the level and severity of security threats vary across the different operations contexts and territories, performance of more in-depth studies of threats feasibility may strongly differentiate the needs for security measures and security outlays. This is particularly relevant for international rail operations which cut across the different risk landscapes, in terms of terrorist attacks, theft and other criminal acts, and also natural disasters. As shown, the security legislation is quite coherent within the EU. Thus the security issue gains prominence when considering competitiveness of European rail equipment and supporting systems manufacturers versus their counterparts from the US and Asia whose security laws and practice may diverge from European standards. One may assume that more secure and reliable rolling stock, traction and signalling equipment from Europe may gain competitive edge over products from countries with lesser security emphasis. However, since security is not the only dimension with regard to which the

rail equipment manufacturers compete in global markets, the issue boils down to how much the security means as compared to other competiveness parameters in a given export offering. Because this issue is a matter of calculation by individual manufacturers and exporters, it cannot be highlighted here.

6.3 Summary

The rationale of security legislation and the resultant expenditures is to reduce the risk from security threats and catastrophic incidents either man-made or natural, or both. In the recent years, researchers from public and private institutions investigated the security enhancing efforts in order to assess the costs and benefits of security regulations. We are still far from the point where security regulation analysis can fully support security-enhancing investments. Yet, because of several very dramatic terrorist attacks and natural disasters which occurred over the last few years we have unfortunately been confronted with the short-term impacts and long-term consequences of insecurity and/or of security breaches. However, this does not obviate the necessity to understand how the costs stemming from compliance with security regulations may affect the costs of production and service provision, and also how these could be reduced by the novel technology and by harmonisation of international law which will reduce the variability in security standards.

Both the public and private spending on security may have positive and negative influence on competitiveness of the European transportation industry, with the net effect being difficult to assess a priori. As argued, security is a global public good which requires international coordination, standardization and maintenance. Because the national governments have the power to negotiate and sign international accords, security is basically the public policy domain. However, the compliance with the national and/or international legislation is a duty of the relevant public and private agents. Which entails that compliance with security legislation may impose some additional costs on the EU, but also on extra-European transport operators and equipment providers. As the rivalry in global transportation markets also involves other competitiveness parameters than security standards (although the latter are quite important), the competitive standing of European industry versus their counterparts from the US and/or Asia is difficult to assess using just the security standpoints.

The literature review on global security economy has shown that many security incidents are rooted in uncooperative individual behaviours whose repercussions fall short of socially optimal outcomes. Therefore, a international harmonisation of security standards may preserve human lives and the global social welfare. Under these circumstances, firms that lower their security performance might gain advantage on the expense of those with higher service provision costs caused by higher security levels. Similarly, firms which maintain high security standards or enhance security preparedness would not be in position to reduce the equipment and /or service costs, and thus may weaken their competitive standing as compared to rivals with lower security outlays. In order to solve this distortion, it is necessary that all firms in the given industry adopt the same standards. However, deliberate adoption of lower security standards for competitive short-term gains may backfire in the long-run. As already demonstrated, the scope of physical and reputational damage imposed on airlines and other transport operators affected by the malicious actions and/or severe

natural disasters have been so huge and long-lasting that they have voluntarily agreed to impose on themselves very stringent security guarantees.

Enforcement of common international security regulations might be complicated because the exposure of the different states towards various categories of security threats and, consequently their vulnerability levels vary broadly. Also, the availability of economic means devoted to upholding the Europe-wide and/or international security standards differs among the different nations. In addition, "security is not the only risk in town" that the targets might be exposed to and have to deal with in the long-run. Both the individual companies but also the entire countries face different risk universe involving different hazard and disaster categories which may deeply affect their economies and even jeopardize the long-term existence. Therefore, synchronization of security protection rules must take into account these differences.

In summary, higher security standards impose higher short and long-term costs on transport companies and transport infrastructure providers. As a result, companies that struggle for financial survival may go bankrupt while trying to implement security regulations. If companies will not get subsidies and/or not improve their technology in order to reduce the costs of compliance, probably fewer companies will be able to offer equipment and services with protection levels sufficient for shielding their own property, personnel, users and clients from probable hazards. However, the severity and the scale of the past security accidents have shown that savings on security measures may bring about calamitous consequences which both the individual companies and national governments have to avoid. Security standards for all transportation sectors have increased over the last years but so did also the scope of criminal and natural threats. In addition, the levels of sophistication, severity and the preponderance of the different threat categories have increased as well. In this context, there is no alternative to security improvements. More cooperation is needed between the different countries in order to attain higher levels of security both in private and public domains. These trends are likely not only to harmonise, but also heighten security requirements all over the world. By so doing they will make the competition on security parameters more fair between the companies from different countries.

6.3.1 Summary of impacts

The following table summarizes the impacts of binding and non-binding legislations as previously assessed.

Table 6: Summary of impacts of policies related to security

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Air	Common rules in the field of civil aviation security (Frame work Regulation)	Regulation (EC) No 300/2008	To protect civil aviation against acts of unlawful interference which jeopardize the security of civil aviation and provide the basis for a common interpretation of Annex 17 to the Chicago Convention on International Civil Aviation.	Common rules in security regulation for all European members may improve competitiveness or at least provide an equal level playing ground for extra-European competition.
Air	Supplementing the common basic standards on civil aviation security	Regulation (EC) No 272/2009	To provide general measures to supplement the common basic standards set out in previous legislation	Better defined general measures facilitate higher compliance with security standards, and in particular, and higher security standards may improve the competitiveness of the transport industry
Air	Supplementing the common basic standards on civil aviation security	Regulation (EC) No 1254/2009	To allow Member States to derogate from the common basic standards on civil aviation security and to adopt alternative security measures	
Air	Amending and supplementing Regulation (EC) No 300/2008	Regulation (EC) No 18/2010	To introduce common specifications for national quality control programs in the field of civil aviation security	
Air	Implementing regulation for Regulation (EC) No 300/2008	Regulation (EC) No 72/2010	To lay down the procedures for conducting inspections by the appropriate authorities in a transparent, effective, harmonized and consistent manner to monitor the application by MS of Regulation (EC) No 300/2008 on selected airports, operators and entities applying aviation security standards.	Inspection of firms in order to check how firms implement security standards will increase people's welfare and reduce risk of security incident. This may require increased investments in implementing those standards but also save costs thanks to the reduction of such incidents.
Air	Security charges	COM 217/2009	To set common principles for levying of security charges at Community airports.	Strengthen competitiveness by increasing firms' transparency and reducing discrimination.
Air	Implementation of the common basic standards by Regulation (EC) No 300/2008	Regulation (EC) No 185/2010	To lay down detailed measures for implementation of common basic standards for safeguarding civil aviation against acts of unlawful interference that jeopardize the security of civil aviation and general measures supplementing the common basic standards.	Strengthen competitiveness by harmonising former restrictions
Maritime	Enhancing ship and port facility security	Regulation (EC) No 725/2004	To enhance the security of ships used in international trade and domestic shipping and associated port facilities in the face of threats of intentional unlawful acts; and To harmonize the interpretation, implementation	Increase international coordination between EU and the rest of the world, which in the increased globalized supply chains might increase the competitiveness the transport industry and other industries.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
			of Community monitoring of special measures to enhance maritime security.	
Maritime	Enhancing port security	Directive 2005/65/EC	To enhance port security in the face of threats of security incidents, and to ensure that security measures taken pursuant to Regulation (EC) No 725/2004 benefit from the enhanced port security.	Defining of general measures for security standards may increase social welfare and reduce risk of security incidents. This may require increased investments in implementing those standards but also save costs thanks to reduction of such incidents.
Rail	Safety on the Community's railways and amending Council Directive 95/18/EC	Directive 2004/49/EC	To provide harmonized framework and approach to rail safety and establishing the roles and responsibilities of the actors involved.	This may increase people's welfare, make the accomplishment of rail safety less costly (in terms of time and money) and reduce risk of security incident..
All	Community Customs Code	Regulation (EC) 1875/2006	To introduce a number of measures to tighten security for goods entering or leaving the Community	To increase security of supply chains, preventing economic and social losses. At the same time it might restrict (to some extent) the external EU trade

7. Industrial Competitiveness Policy (TØI)

There is no European specific industrial competitiveness policy but rather a collection of different provisions which collectively affect the European industry competitiveness. Therefore, in an attempt to review this subject as completely as possible, in addition to competition, we also discuss industrial and intellectual property rights policies, policies guiding internal market, external trade, economic and finance rules, and research and innovation. Industrial competitiveness policy is also closely related to transport, environmental and social protection and energy policies which are reviewed separately in the preceding and following chapters.

Wider understanding of industrial competitiveness policy is also in line with the EC industrial strategy for globalization (EC 2010/C614) adopted in response to increased industrial internationalization, growing societal challenges (aging population), resource scarcity, - including human (skills and knowledge shortages), energy-related and environmental constraints, but also those pertaining to integration of global value-adding industrial activities, and supply chains.

7.1 Main industrial competitiveness related policies

Competition policy affects the European industrial competitiveness at both intra and extra EU levels. The State Aid, antitrust and merger control policies exert supervision of investment and over restructuring of identified industries/companies which seek public funding to improve performance and competitiveness while at the same time avoiding competition distortion and harming the consumers. Balancing these objectives is difficult, also in the field of transport where sometimes it is necessary to pursue conflicting goals such as free competition, rationalization of transport services to improve efficiency and quality and sustainable mobility. Therefore, to address these issues, both the binding and informal policy legislations are used.

In contrast to competition policy, no EU-wide binding industrial legislation has been adopted over the last years. Instead, a series of European Technology Platforms, Joint Technology Initiatives (JTI) and other initiatives also relevant for transport industry were established to support technologies central to development of industrial policy. These types of soft policies are linked to other policy fields (internal market, external trade, economic and financial aid and research and innovation), for which both the formal and informal policies have been adopted.

7.1.1 Formal legislation

Competition policy

Conditions for State Aid, mergers and antitrust controls are govern by binding legislation in order to ensure that national subsidies and companies' restructurings do not conflict with TFEU prohibition of horizontal and vertical agreements and other concerted anticompetitive practices which may lead to abuse of dominant market positions. Although the DG Competition is the main agent responsible for this policy, the DG Enterprise and Industry is also involved in both the policy development and enforcement to assure it does not harm business interests of specific industrial sectors.

State Aid

State aid control empowers the EC to monitor subsidies that MS extend to certain sectors and companies. By so doing it counteracts market failures without however compromising free competition at national and EU levels. As market circumstances change, the rules are also regularly reviewed. In 2012, the ceiling under which the aid did not need to be notified defined by the "de minimis aid rule" for undertakings providing services of general economic interest (SGEI), to which also transport networks belong, was increased from EUR 200.000 to EUR 500.000 by Regulation (EU) No 360/2012 (EC 2012/360). The new State Aid Package for SGEI followed a communication (EC 2011/C146) which aimed at making compliance easier and more efficient. Another example of policy adaptation is the "Temporary Community Framework for State Aid Measures to Support Access to Finance in the Current Financial and Economic Crisis" (EC 2009 b) which was launched in response to financial and economic crisis and whose objective was to encourage the companies to invest in sustainable long-term projects. Regular policy reviews enable the EC to consider limitations and restrictions of prolongations, and also when viable, reverse to "the normal" state-aid rules (EC 2011 v).

Simplifying procedures for exempted aid, improving transparency and efficiency of inspections was pursued by Regulation (EC) No 800/2008 (EC 2008/800) whose adoption also widened the exemptions. To the categories compatible with state aid legislation, which contribute to industry competitiveness, also belong research, innovation and training.

In addition, several communications specified below complement binding legislation on the state aid by providing guidelines for specific industrial sectors:

- *"The Framework on State Aid to Shipbuilding"* (EC 2011/C364) streamlines specific provisions regarding innovation and extends the rules for export credits and regional aid until 31/12/2013 for shipbuilding sector. The rules provided in the new framework are extended to inland waterway vessels, as well as floating and moving offshore structures
- Guidance on state aid to ship management companies (EC 2009/C132) authorises ship management companies to apply for the tonnage tax scheme (by which tax is calculated applying a notional annual income on its net registered tonnage) and not on its profit or loss, despite of outsourcing part of a ship operation (crew or technical management). This authorisation is however only valid if the ships managed are fully compliant with international safety rules or crew managers apply substantial provisions of the 2006 Maritime Labour Convention, depending on the operation outsourced.
- Guidance on State aid complementary to Community funding for the launching of the motorways of the sea (EC 2008/C317) authorises State aid for selected Marco Polo II projects up to 35 % of operational costs over five years as well as State aid to start up investments in TEN-T MoS projects up to 30% for two years. This measure will enhance financial support from the European Union.
- *Community guidelines on state-aid for railway undertakings* (EC 2008/C184) clarify the rules under which MS aid may apply so that liberalization of rail transport and the development of sustainable mobility are supported. It includes guidelines on infrastructure funding for RUs and aid for the purchasing and renewal of rolling stock, restructuring processes, coordination of transport and cancellation of state debt.

Antitrust

Antitrust rules derive from Article 101 and 102 of the TFEU prohibiting horizontal and vertical agreements between two or more independent market operators which restrict competition and abuse the dominant market position. Like in the case of State Aid control, some sectors and activities are exempted. The most recent 2009 legislation applying to transport industry maintains that

- Agreements, decisions and concerted practices within rail, road and inland waterways which might facilitate technical improvements or cooperation (standardization of equipment, coordination of timetables and routes, rationalization of transport, and tariff structure uniformity) are exempted from collaboration limitations. Also exempted are groups of small and medium sized undertakings whose capacity volumes are determined (Council 2009/169).
- Likewise, joint adjustment of capacity between liner shipping services under supply and demand fluctuations, usage of port terminals and computerised data exchange systems, and promotion of consortium vessels use are allowed provided they do not exceed certain market share limits (EC 2009/906).
- In a similar fashion, certain agreements between European air transport companies allowing joint scheduling and coordination, consultations on tariffs, joint operations on less busy routes, slot allocation and airport scheduling and CRS purchases and/or development are also permitted (Council 2009/487).

Mergers

Similar to antitrust rules, merger control legislation prosecutes the anticompetitive firm behaviours and regulates the scope and the content of mergers and acquisitions. Guidelines published by the European Commission are meant to help companies interpret these rules. Regulations have also been adopted to exempt certain horizontal and vertical agreements from such restraints. Block exemptions exist for certain types of vertical supply agreements that may have positive effects such as minimising distribution costs, increasing production efficiency and optimising investments. However, as in case of antitrust and state aid, to avoid competition distortion, certain conditions need to be met to benefit from such exemptions (EC 2010/330), and thus, sector-specific legislation may also apply. For example existing binding legislation (EC 2010/461) draws a distinction between (a) vertical agreements for distribution of new motor vehicles and (b) agreements for repairs and maintenance and distribution of spare parts. It extends block exemption for vertical agreements to purchase, sale or resale of new motor vehicles as stated by former regulation[68] until 31.05. 2013. From that date on, the same regulation (EC 2010/330) shall apply as for vertical agreements for the purchase, sale or resale of spare parts for motor vehicles, or for the provision of repair and maintenance services for motor vehicles.

Research and Innovation Policy

Policies encouraging and increasing efficiency of R&D are decisive for Europe's world leadership in research and industrial applicability of R&D results. By contributing to development of market ready products and services from which European transport manufacturing and service provision industry can benefit, these funds seek to make most out of them.

[68] Regulation 461/2010 replaces Regulation 1400/2002, but vertical agreements relating to the purchase, sale or resale of new motor vehicles have more time to adapt to the new legislation.

To achieve these objectives, European policies have promoted multidisciplinary and multi-stakeholder research cooperation. Establishment of six Joint Technology Initiatives, five of which are closely related to transport industry - Clean Sky, Hydrogen and Fuel Cells Initiative (FCH), Embedded Computing Systems (ARTEMIS), Nanoelectronics Technologies 2020 (ENIAC) - and the Global Monitoring for Environment and Security (GMES)[69]. The main goal of these regulations is to provide research initiatives with appropriate structures that enable efficient coordination of knowledge production and fund procurement, and for GMES - set out the rules for continuation of the European satellite navigation programmes EGNOS and GALILEO. Worth mentioning is also that one of the six criteria for establishment of JTI is the "*scale of the impact on industrial competitiveness and growth*".[70] The scope and the main characteristics of JTI and its relevance for transport industry are described in section on "Informal legislation, research and joint activities" in the present, previous and coming chapters, depending on the main field covered by the JTIs.

As transport industry is to deal with complex challenges such as climate change, increased demand, changing mobility patters and scarcity of resources and energy supply, broad multi-disciplinary approach is required. Yet international cooperation between different research disciplines and research institutions and industry needs to be improved. The same relates to other policy areas such as public procurement, simpler and cheaper IPR, access to finance, modernization and greater investment in education, and also harmonization of legislation and standards in line with the recent technological developments. All this is identified in the "*Europe 2020 Flagship Initiative for Innovation Union*" Communication (EC 2010/C546), which goes a step further, and calls for turning innovation into an overarching objective of any policy measure. According to this document the target for R&D investment is set at 3% of GDP. According to another EC's communication issued in 2010 (EC 2010/C2020) the share of GDP dedicated to investment was below 2% and thus not only below that target but also below US (2.6%) and Japan's (3.4%) investment levels.

The Executive Agency for Competitiveness & Innovation (EACI) helps the Commission to efficiently manage the EU programmes in the areas of Competitiveness and Innovation.

Economic and Financial Affairs

Access to finance is a barrier for firms which want to invest in innovation and/or long-term sustainable practice, and/or survive the pressures of financial global crisis. How the competition legislation seeks to alleviate this problem through state-aid, merger control and antitrust legislation has already been mentioned. Another mechanism, which currently is in the pilot phase, is the EU

[69] These initiatives were established by the following legislation: The Council. 2007. Council Regulation (EC) No 521/2008 of 30 May 2008 setting up the Fuel Cells and Hydrogen Joint Undertaking. Brussels: The Council; The Council. 2007. Council Regulation (EC) No 74/2008 of 20 December 2007 on the establishment of the 'ARTEMIS Joint Undertaking' to implement a Joint Technology Initiative in Embedded Computing Systems. Brussels: The Council; The Council. 2007. Council Regulation (EC) No 72/2008 of 20 December 2007 setting up the ENIAC Joint Undertaking. Brussels: The Council; The Council. 2007. Council Regulation (EC) No 71/2007 of 20 December 2007 setting up the Clean Sky Joint Undertaking. Brussels: The Council; and European Parliament and the Council. 2008. Regulation (EC) No 683/2008 of the European Parliament and the Council of 9 July 2008 on the further implementation of the European satellite navigation programmes (EGNOS and Galileo). Strasbourg: European Parliament and the Council.

[70] European Commission, Research and Innovation, accessed March 20, 2013. http://ec.europa.eu/research/jti/index_en.cfm?pg=about

bond initiative, whose aim is to "*help finance priority projects with a clear EU added value, and to facilitate greater private sector involvement in the long- term capital market financing of economically viable projects in the field of transport, energy and ICT infrastructure"* and *"produce greater benefits in terms of market impact, administrative efficiency and resource utilization"* (EP & Council 2011/670). The purpose of this pilot is to facilitate its introduction to the market, familiarize stakeholders with new financial instrument, and enable feedback for subsequent improvements. The pilot phase (2012-2013) is managed by the EIB.

Internal Market

Public procurement is an important market for transport industry. Therefore, is should serve as a catalyst boosting innovation and competitiveness. However risk aversion, lack of knowledge and fragmentation of this market hinder both the innovation and the necessary investment levels, despite the fact that the recent legislation (EC 2011/1251) increased the contracts' value thresholds (excl. VAT). Two directives have been proposed (EC 2011/C895 and EC 2011/C449) to simplify rules and make them better suited for the evolving political, social and economic contexts and needs for efficiency in public spending while at the same time not compromising equal treatment of bidders. But none of them have yet been adopted. Nevertheless, changes proposed make dialogue and negotiations much easier, as they facilitate cross-border procurement, reduce the documentation requirements, and facilitate usage of electronic channels. Trademarks are also regulated by internal market policy. After national law approximation took place in 2008 (EP & Council 2008/95), the binding European legislation was adopted in 2009 (Council 2009/207) which established rules and conditions for granting and protecting the Community trade-marks.

External Trade

Binding external trade legislation was recently adopted which might have affected the competitiveness of the European transport industry, given the increasing internationalization of its business. They mostly regard either rules to counteract monopolies, state subsidies and dumping practices of third countries or rule implementation of international agreements:

- Regulations (EC) No 260/2009 (Council 2009/260) and (EC) No 625/2009 (Council 2009/625) established common rules for imports into the European Union (EU) from, respectively, WTO and non WTO-countries based on principle of import freedom, and defined procedures enabling the EU to implement the surveillance and safeguard measures required for protection of its interests,
- Regulation (EC) No 1225/2009 (Council 2009/1225) on protection against dumped imports from non EU members set out rules for how to protect the EU industry against dumped products whose release for free circulation within the Community may injure producers of the same or similar items,
- Regulation (EC) No 597/2009 (Council 2009/597) protects the EU industry against harms caused by subsidised imports from non EU members.

7.1.2 Informal legislation, research and joint activities

Integrated industrial policy for the globalization era

The Commission's *integrated industrial policy for the globalization era* (EC 2010/C614) recognizes the need to improve the transport infrastructure (as well as energy and communication ones) in order to reap the quality and efficiency gains and enhance competitiveness of Europe's entire industry. As it is not possible to rely entirely on public sources as regards transport investments, attracting private and foreign investors plays a major role in this strategy. This, along with the recovery and a long term stabilization of financial markets are two political objectives expected to improve European business's prospects for credit. Yet, business, at the same time, may need restructuring to avoid overcapacity.

Due to the economic turndown the Commission has been urged to update the in 2010 published industrial policy in a new communication - *A Stronger European Industry for Growth and Economic Recover* (EC 2012/582) -, which besides the general need to facilitate financial access of business, also stresses the necessity to facilitate investment in innovation, improve market access and develop human skills. The Communication identifies six areas where investment in new technologies and innovation may have a greater impact both at the short, medium and long term. Among those we find clean vehicles and vessels.

The relevance of transport springs also from the fact that the EC has supported specific initiatives in the motor vehicles manufacturing and transport equipment industries, which are also strongly related to policies aimed at improving the energy efficiency and reducing the environmental impact of business.

Additionally, since European businesses consist mainly of small and medium companies with large contribution to European economy[71], helping SMEs to internationalize is a key objective of European competition strategies, as the Commission's communication *Small Business, Big World - a new partnership to help SMEs seize global opportunities* (EC 2011/C702) points out. Support for SME involves easing market access through establishment of EU business centres in India and China, and establishment of transatlantic IPR portal and related help desks providing information on markets and regulatory issues (including IPR and trade barriers to exports). The enlargement of the Enterprise Europe Network (with now more than 600 partners worldwide) and its website is also an internationalization supporting measure at intra and extra EU levels. Bilateral and multilateral policy dialogues (exemplified by negotiations with Brazil, Canada, China, India, Japan, Russia and the USA as well as with international trade bodies such as UNECE and WTO) aim at unifying policy framework for SMEs. Furthermore, the support for several research studies helped also to identify main barriers and advantages of SME internationalization.[72]

[71] According to ECORYS' *Annual report on small and medium-sized enterprises in the EU, 2011/12* (ECORYS 2012), SMEs accounted for more than 98 per cent of all enterprises, 67 per cent of total employment and 58 per cent of gross value added (GVA) in 2012. No figures could be obtained for transport manufacturing and service sector in 2012, but in 2008 according to some *Key figures on European business with a special feature on SMEs* (Eurostat 2011), the "transportation and storage" sector's 90.3 per cent of enterprises were micro businesses, while almost 7.9 per cent were small units, 1.5 per cent accounted for the medium ones, and only 0.3 were large-sized. The first three (micro-, small- and medium-sized) accounted for half of the persons employed and almost half of the value added within the sector. Labor productivity showed highest figures in large-sized business (EUR 47,000 /person) and decrease with the size, being EUR 45,000/person for medium-, EUR 43,700/person for smalls and EUR 35,000/person for micro companies. For the same year 81.4 per cent of the people employed in the manufacturing of motor vehicles, trailers and semi-trailers were employed in large-sized business. For the air transport this figure was 87.7 per cent.

[72] European Commission, Enterprise and Industry, SME, accessed March 20, 2013

In its policy strategy (EC 2010/C614), the Commission also emphasizes other needs, which could be further detailed as encompassing

- Better analyses of policies' impacts both before and after implementation
- Legal harmonization within EU, especially of the business-related services on which industrial manufacturing depends heavily
- Improvement and better enforcement of IPR to avoid negative effects on both the industry and society
- Better commercialization of research breakthroughs into market-ready products
- Stronger public-private cooperation for improving skills and training
- Monitoring and counteracting discrimination against European products in extra EU markets
- Ensuring access to natural resources and sustainable resource consumption (and even reduction) by promoting European sources, recycling and higher resource efficiency (see also the chapter on energy policy)
- Promote CSR

The SMEs strategy may also be favoured by the *Entrepreneurship 2020 Action Plan* (EC 2012/C795). This action plan is mainly conceived to promote growth and create employment by setting out a series of actions making entrepreneurship more appealing and facilitating both the creation and the growth of new business. These actions are based on three pillars: developing entrepreneurial education and training (both at a basic and a high educational level and within and outside educational institutions), creating the right business environment, changing entrepreneurship's perception and adapting to specific groups (women, senior and migrants) which have a great potential to become entrepreneurs. For improving the business environment the plan foresees to provide entrepreneurs with better access to finance (both in the capital market and through finance programmes such as COSME[73], HORIZON, PSCI[74]); support them (especially in the early stages) through the reduction tax compliance cost, the removal of barriers that prevent them from developing cross-border activities and developing business networks where they can exchange experiences and knowledge; highlighting the relevance of ICT and digital technology; introducing measures and improving information on market expansion and business transfers; giving honest bankrupts a second chance; and making rules clearer and simpler and eliminating those which are not necessary.

Enhancing enforcement of intellectual property rights (EC 2009/C467)
The formal legislation on protection of intellectual property rights (IPR) dates back to 2004. However, the spread and professionalization of counterfeiting and piracy to a wider spectrum of business sectors required adjustment and improvement of the existing rules. The European Observatory on Counterfeiting and Piracy was created in 2008 as a response to the Council's Resolution of 25 September 2008 demanding more effective fight against counterfeiting and piracy.

http://ec.europa.eu/enterprise/policies/sme/index_en.htm
[73] Programme for the Competitiveness of Enterprises and SMEs
[74] Programme for Social Change and Innovation

The Observatory improves the quality of information and statistics related to this issue, identifies and spread the national, public and private best practices and enforces techniques which help to raise public awareness[75]. Other measures identified by the EC included fostering of European administrative cooperation and voluntary agreements between stakeholders.
The Observatory entrusted in June 2012 the Office for the Harmonization in the Internal Market with a duty to promote dialogue between stakeholders on support for these measures (EP & Council 2011/386).

European Strategy for the Key Enabling Technologies (KET) (EC 2009/C512)
This strategy focuses on product and service development as described in the industrial policy strategy. However, its central theme goes further and consists in formulation of KET. To lift the lack of common understanding between the member states of what to be considered as KET, the Commission proposes nanotechnology, micro and nanoelectronics, photonics, advanced materials and industrial biotechnology as most relevant for helping Europe to face resource, environmental and social challenges and benefit from global opportunities. All of them are relevant for the transport sector. Advanced materials can make all kind of vehicles lighter, and reduce fuel/energy consumption. Microelectronics applications are present in automotive industry for safety management, fuel efficiency and engine controls. Biotechnology enables production of alternative fuels. Automotive and aerospace industries are also interested in nanotechnology and photonics which can provide new transportation-powering solutions. The Commission assumes its responsibility for laying down favorable framework condition for development of the above technologies, and identifies a series of problems and remedial actions to overcome them. According to the document, main reasons for the incapability to translate research results into market ready products and services are R&D knowledge leakage (which could become more serious problem as a result of increased production outsourcing), public fear against new technologies (due to insufficient understanding), shortages of skilled workforce, low funding for venture capitalists and private investors, insufficient harmonization of regulations, standardization and certification, the current public procurement procedures, lack of transparency in the state aid, and finally, the lack of long-term visions and synergies from academia-industry collaboration. To enable transfer of technology knowledge from research institutions to industry and enable Europe to profit from its R&D leadership, the following is suggested: facilitate information and earlier participation of industry in R&D activities; further incentivize collaboration between all stakeholders (MS, funding and research institutions, industry, etc.); expand help beyond the European supportive instruments such as the European Institute for Innovation and Technology (EIT) and Enterprise Europe Network; improve the state-aid policy and IPR protection; reduce trade distortions (subsidies, tariffs and non-tariff barriers); support commercialization of technological innovations through initial funding (Competitiveness and Innovation Framework Programme); assess the international technology policies; infuse engineering and business studies with environmental and green skills; promote natural sciences and engineering studies among European students; and attract international talents.

International Affairs

[75] European Commission, The EU Single Market, The European Observatory, accessed March 18, 2013 http://ec.europa.eu/internal_market/iprenforcement/observatory/index_en.htm#maincontentSec3

External trade and affairs cannot always been ruled by hard legislation. In fact, most global agreements are of non-binding character, so informal legislation is required. Negotiations on removal of tariff and non-tariff barriers (standards, technical or legal demands) within the framework of the Doha Development Agenda seek to open world markets and unlock new opportunities for European products and services.

Bilateral free trade agreements with key countries (Chile, South Korea, Mexico, and South Africa) and with the Central America and Andean Community regional associations and MERCOSUR as well as ongoing FTA negotiations (Canada, India, Malaysia, Singapore, Ukraine, ASEAN countries and the Gulf Cooperation Council) seek to improve those chances without interfering with other multilateral agreements. Commitment to improve external trade relations is also included in the work to develop stronger ties with emerging and neighbouring countries (Mediterranean and Eastern European and non-European).

Another international issue which is relevant for competitiveness of the European transport industry is EU enlargement which, on one hand, may create new opportunities but, on the other, may need closer monitoring to ensure that political, legal and technical European standards are respected. It is important to mention that the accession and candidate countries which benefit from pre-accession funds as well as members of the European Free Trade Association (EFTA) which participate in European Economic Area (EEA) have also access to Competitiveness and Innovation Framework Programme.

The Executive Training Programme represents still another tool which seeks to help the European SMEs to perform in two specific countries, Japan and South Korea. By providing aspiring investors with cultural courses, business and language training, internships at local companies, and support for business plan development, this initiative equips European business people with context specific skills.

Sustainability and Corporate Social Responsibility

The DG Enterprise and Industry website states that "*competitiveness and sustainability are mutually reinforcing concepts*" and "*Corporate Social Responsibility (CSR) is a necessary and natural counterpart to the drive for a more competitive Europe*". Therefore, it seems reasonable to search for impacts that sustainable and CSR related policies may exert on the competitiveness of European transport industry.

European policies promoting CSR are mainly (and will expectedly be) of non-binding nature. Their principles and guidelines are issued in the form of communications. The latest, issued in 2011 seeks to create conditions for facilitation of voluntary adoptions and implementation of CSR, provide dialogue spaces such as the *European Multi-stakeholder Forum on CSR* and *the European Alliance for CSR* to discuss European CSR policies, mobilize resources to improve CRS awareness and develop coalitions bettering the environment for CSR development. At least two of the goals of the Commission's CSR strategy (EC 2011/C681) are related to global perspective. One is the aligning of European policies, which should better integrate the national policies with global guidelines and

principles, and another is the promotion of CSR principles through external policies towards candidate countries and firms that want to expand abroad. The EC also aims at increasing the role of environmental and ethical issues in public procurement and funding and at improving the reporting practices on adherence to social and environmental legislation. Furthermore, it plans to counteract unfair commercial practices such as green-washing. The creation of multi-stakeholder CSR platforms in specific industrial sectors is also planned, but none of them so far in transport sector.

The rationale for inclusion of CSR policies derives from the fact that sustainable businesses are concerned with resource efficiency and impacts that their activities impose on environment. Adopting practices and strategies that deliver short-term, but mostly long-term sustainable benefits such as reduced energy consumption and environmental footprint, can reduce costs of production, increase productivity, improve corporate image and customer loyalty, and attract R&D investments (for instance to implement circular economy). Furthermore, companies that follow the CSR principles, also better meet stakeholders' expectations. CSR adoption may also improve the knowledge of markets (both of demand and supply sides), help to avoid future problems, and/or better tackle the current ones. Also from a multi-stakeholder perspective, higher CSR adherence may also improve collaboration, and employees' commitment to company's goals. Besides, transparency is also a backbone of CSR and it can contribute to more open competitive environment.

Transport related sector specific strategies

The Motor Industry

The latest Communication (EC 2009/C104) on the automotive sector identifies causes for its current downturn (financial crisis, drop in demand, access to credit, high fixed costs, overcapacity, intensive price competition and poor access to new markets), and describes common policy framework, which is key for the automotive sector due to the industry's large spread across the EU and its links with many other sectors, to cope with these problems.

The main lines of policy action with regards the automotive sector are the following: CARS 21 to develop policy in cooperation with stakeholders; facilitation of access to finance by returning stability to financial markets and making temporally available sector specific state-aid to improve liquidity; support for research and research partnerships; simplification of public R&D programmes; fostering demand for new vehicles through public procurements; advancement of technical standardization; and removal of trade restrictions. Besides, social, environmental and energy related policies are also needed for boosting the sector's competitiveness.

The Competitive Automotive Regulatory System for the 21st century (CARS 21) was set up in 2005. Since then several documents were issued, the latest one the *CARS 21 High Level Group on the Competitiveness and Sustainable Growth of the Automotive Industry in the European Union* (EC 2012 d) in which a vision for automotive sector in 2020 was presented. The strategy will be implemented within the *CARS 2020 action plan for a competitive and sustainable automotive industry in Europe*. A key issue targeted is modernizing the UNECE 1958 Agreement in line with needs of global markets so that the industry can benefit from lower compliance costs and economies

of scale without compromising the required safety and environmental rules. Generally the removal of tariff and non-tariff barriers through FTAs and regulatory cooperation was identified by the CARS 21 HLG Final Report as a key measure to improve global competitiveness. Other issues on which the stakeholders should jointly work included:

- Improving business conditions in Europe so that manufacturing can stay in Europe (anticipating changes, needs for skilled workforce, access to finance and transparency in vertical agreements, and restructurings, if needed)
- Reducing pollutant and noise emissions through an integrated policy approach involving development of an appropriate methodology to evaluate emissions, establishment of technically feasible targets, and making information on provision of CO2 labels more transparent.
- Deploying new mobility solutions such alternative fuels and corresponding infrastructure, ensuring interoperability across the EU through standardization without, however, compromising the freedom of movement and integrity of the common market.

Shipbuilding

The most direct strategy dealing with competitiveness within the sector is the LeaderSHIP initiative 2015. Created in 2003 this provision is currently being reviewed in order to enable European shipbuilding industry to benefit from new opportunities (i.e., offshore activities) and adapt to new markets, and financial, environmental and social demands. The review process involves MS, the EU regions, industry and trade unions all involved in Coordination Group (CG) that steers three groups working devoted to the following matters:

- WG on international competitiveness (improving market access and fair conditions) and access to finance (including those necessary for environmentally improvements and diversification of business sectors)
- WG on research and innovation
- WG on employment and skills as aimed at identifying new qualifications needed for increasing the sector's attractiveness, analyzing measures for harmonizing qualifications and mobility of skilled workers, and discussing strategies for extended Life Long Learning (LLL), skill upgrading and acquisition of new skills strategies.

Aeronautic industries

The European strategy to ensure industry competitiveness is *based on research network and balanced regulatory framework*, as described in the vision for aviation (EC 2011 g).
Most of this sector's policies are of binding nature, and have been or will be reviewed in previous and coming chapters. Besides, the EC requires that aircraft manufacturers from outside Europe (US) adhere to fair trade conditions by monitoring their government subsidies.

New opportunities emerge also from highly advanced Remotely Piloted Aircraft Systems (RPAS) produced by research. From 2009 onwards, after a series of public hearings and stakeholder consultation were conducted, the European Commission set up a European RPAS Steering Group (ERSG) and a public database to develop and implement a roadmap that integrates safety, regulatory and technical deployment of RPAS in civil aviation.

Space industry

The space sector policies are also relevant because they spillover to other industries including transport. Two objectives of the latest strategy (EC 2013/C108) seek to develop markets for space applications and services by ensuring technological non-dependence and independent access to space. Possible outcomes would be commercial spaceflights or, more realistically, development of satellite navigation applications using EGNOS and Galileo. Such applications could improve satellite radio navigation for the existing transport (i.e., air-traffic control) or open new possibilities for multi-modal operators by improving fleet management and location of freight conditions.

Tourism

Tourism policies also pertain to transport industry, and especially to services, since they provide mobility for tourism industry. Measures aimed at reducing seasonality and environmental impacts of tourism-related transport, seem quite relevant. In a pursuit of retaining Europe's leading position as *the world's No 1 tourist destination – a new political framework for tourism in Europe* (EC 2010/C352) was adopted which incorporated actions with impacts on transport industry. Measures include gauging consumer satisfaction with tourism services (including transport), awareness-raising campaigns regarding trip destinations and transportation means, and campaigns such as "Calypso" or "50.000 Tourists" to promote travel during low seasons. The planned or the ongoing actions may further increase or change the demand (by shifting transport modes), and/or enhance service quality. Furthermore, plans to create a "Europe brand" enabling international differentiation of European destinations may, also extend to other sectors, especially those linked to tourism such as air transport or cruise sector. There is also abinding legislation related to tourism which is relevant for the transport industry. For example Directive 2009/47/EC (Council 2009/47) enables MS to apply for reduced VAT to services which are labour intensive.

European Transport Platforms and Research and Innovation initiatives

The EC's *Scientific Assessment of Strategic Transport Technologies* (EC 2012) mentioned several research and innovation fields which might have the highest leverage on transport industry competitiveness. These include the following:

- intelligent transport infrastructures,
- production technologies for alternative fuels,
- design and manufacturing processes for innovative and effective road vehicles,
- design, manufacturing powering and propulsion systems for innovative and efficient ships and barges,
- materials and structures, design of new propulsion technologies for aircrafts,
- design, materials and structures for innovative and efficient trains
- new materials-enabling technologies
- advances in aerodynamics
- unmanned aircrafts and public transport solutions
- service-oriented based mobility transport

Advanced Research and Technology for Embedded Intelligence and Systems (ARTEMIS) is one of the ETPs (originally launched in 2004) which evolved into a joint undertaking[76]. The ARTEMIS JU is a public-private partnership between the EC and the ARTEMISIA Association, funded in 2007. Its 200 or so members and associates include large firms, SMEs, universities and research institutes. Its goal is to implement the SRA[77], whose overarching goal is to maintain strong technological capability in supply and application of embedded systems by overcoming component and tool fragmentation, through co-ordination of research activities and issuing of open calls for proposal. Selected projects are co-funded by the EC and the MS that joined the ARTEMIS JU. ARTEMIS developments may improve and/or deliver new applications for transport manufacturing and infrastructure sector (airports, highways) or, aerospace. According to (EC 2009 a) embedded electronics are especially relevant for automotive sector, where they already make up 20% of the car value, and this figure is expected to increase to 35-40% by 2015. The same document also states that the automotive embedded systems are supposed to create 600 000 new jobs in Europe.

The *European Nanoelectronics Initiative Advisory Council (ENIAC)* launched as ETP in 2004, became a public-private joint undertaking in 2008[78]. It brings together MS, the EC, and AENEAS (an association representing European R&D actors in this field). Its focus is on increasing private and public investments in nanoelectronics, coordination of projects selected for public funding (till 31 December 2017), and maintaining strong technological expertise by European semiconductor manufacturers. The projects selected shall enhance integration and miniaturization of devices, increase functionality, deliver new materials, equipment and processes, architectures, manufacturing and design methodologies, new packaging, and new ways of 'systemising' these achievements. Besides, this initiative is to define and implement the SRA in order to produce synergy by coordination of European R&D efforts and promotion of SME participation. The initiative focuses on six application domains, including mobility and transport. Nanoelectronics can improve cars' fuel and energy efficiency, while semiconductors and microelectronics can be used in transport applications such as car/truck navigation systems.

The aim of *European Technology Platform on Smart Systems Integration (EPoSS)* launched in 2006 was to develop a vision for setting up a SRA on Innovative Smart Systems Integration, define the R&D and innovation needs, and policy requirements. Despite of being industry-driven, the platform brings together European private and public stakeholders including large companies and SMEs, public and private research organizations, universities, public representatives and other key actors in areas of Smart Systems Integration, Micro-Nano-Bio Systems, microsystems nanotechnologies and related applications. EPoSS collaborates with Green Cars Initiative and CARS21, and other ETPs and industry stakeholders (EUCAR, ERTRAC, SmartGrids). Smart systems applications fall mainly within automotive and aerospace sectors.

With regards the automotive sector, EPoSS research priorities are safety, driver assistance,

[76] The ARTEMIS Joint Undertaking (JU) was formally established in February 2008 by means of a Council Regulation (EC) No 74/2008
[77] ARTEMIS latest Strategic Research Agenda was published in 2011
[78] ENIAC JU was established by Council Regulation (EC) No 72/2008

convenience, energy efficiency and smart power trains, in addition to cross-over technologies. The first three contribute to safety and offer added-value to drivers which may affect car/truck purchasing behavior while energy efficiency and smart power train advancements shall minimize energy use thus making driving cleaner, and allowing the vehicles to be more efficient and resource and environmentally suitable.

As regards the aerospace sector, EPoSS has identified smart systems-related technologies that can enable the industry to overcome the ACARE challenges. These include electrification of certain aircraft components (i.e., pneumatic, hydraulic), better connectivity between the aircrafts (i.e., aircraft-to-aircraft, aircraft-to-ground, new passenger accommodation features, remote maintenance), improving market chances for intelligent aircrafts (from cabin control functions to the fully automated freight aircraft), and making flying more efficient. Besides, smart systems may contribute to automation of logistics, making services more reliable and efficient without human intervention. Furthermore, the ITS applications such as vehicle-to-vehicle and vehicle-to-infrastructure communications may optimize route planning, increase vehicle safety and efficiency.

The *European Steel Technology Platform (ESTEP)* started in 2004 with a goal to maintain and reinforce the EU steel industry's global leadership by using research and innovation to develop new products and processes that will foster competitiveness while, at the same time, meeting the growth and the environmental targets. This includes the launch of a SRA, whose latest version dates back to 2006. In the transport area, the ESTEP focuses on developing better steel technologies for transport equipment. In particular, the automotive industry collaborates with ESTEP's work on the Green Car initiative.

The *European Space Technology Platform*, launched in 2005, provides a long-term vision for space technology, and R&D by generating synergies between the space and non-space technology platforms, promoting join upstream research on technologies of dual-use (civil and security), designing the technology R&D strategies, and facilitating international cooperation. As mentioned, focus on innovation may be relevant for transport industry since it may contribute to development of new market applications.

The *Advanced Engineering Materials and Technologies (EuMat)* was launched in 2006. Besides developing the SRA (latest updated version from 2012), this ETP together with other 6 ETPs (among them ESTEP and Manufuture) has written an open letter to the EC for Research, Innovation and Science and for Enterprise and Industry to underscore the importance of research on new materials in the upcoming Horizon 2020 Programme. Possible applications within transport sector include:

- Material, manufacturing and product lifecycle modeling, integration of computational modeling with experimental and testing techniques to enable cost effective production, and use of traditional and innovative materials (nano) in aerospace, automotive, rail and marine industries.
- Energy related materials such as those resistant to high temperature and corrosion for vessels and heat exchangers, renewable materials for biofuels, and for hydrogen and energy storage (batteries).

- Nanomaterials and Nano-Assembled Materials
- Knowledge-based structural and functional materials for coatings applied in aerospace and automotive industry by exploring their mechanical and thermal responses
- Materials for Information and Communication Technologies (ICT) to enhance safety, efficiency and pollution reduction in the transport

Because of high labour costs, ageing population, necessity to monitor natural environment and needs for operations under conditions dangerous for humans, industrial robots are increasingly extending their application domains. *The European Robotics Technology Platform (EUROP)* works on this issue. The ETP was launched in 2005, and its latest updated SRA dates from 2009. It works on maintaining the European robotics industry's leadership. The EUROP participates in the ongoing project "The European Robotics Coordination Action" whose aim is improving the cooperation between robotics stakeholders in academia and industry, promoting the European robotics and strengthening the European robotics community across all sectors (industrial, professional service, domestic service, security and space robotics). Development of robots may improve manufacturing and assembling processes. Consolidation of this platform with transport industry will be essential for further exploring and exploiting technologies for autonomous transport alternatives for freight and passengers at small and large scales. Possible technology transfers and joint applications in transport sectors involve collision avoidance (sensors), systems engineering tools, real-time communication, new locomotion solutions, and management of power and storage facilities.

The *Integral Satcom Initiative Technology Platform (ISI)* was launched in 2006 and gathers major private and public stakeholders of satellite communications (SatCom) and space sector in Europe. ISI focuses on integration of fixed and mobile satellites and terrestrial networks. Especially relevant for transport industry is ISI's work on Galileo, GMES and the use of Unmanned Aerial Vehicles, as a part of efforts to integrate satellite communications with navigation, earth observation, and air traffic management systems (ISICOM). Satellite communication solutions can support drivers in route selection by providing information on traffic disruptions via fixed or mobile broadcast systems as well as enhance traceability of goods and vehicles that are out of reach from terrestrial signals and/or satellite imagery. This may translate into more effective transport flows and increased security and efficiency in transport and logistics performance.

According to its latest SRA (2006) the *Manufacturing European Technology Platform* was launched in 2004 with an aim to contribute to transformation of the European manufacturing industry into a knowledge-based sector capable of creating high-value-adding products, processes and services and securing employment for high-skilled workers to successfully compete in globalised marketplace. The platform is also a private driven undertaking whose participants involve SMEs, large companies, research institutes, associations and governmental bodies. Manufacturing ETP identified some issues that the European manufacturing industries must address in order to cope with increased pressure from other developed economies, technology advancements (shortening of life cycle), high environmental sustainability standards and socioeconomic and regulatory changes:

- *new, high- added-value products and services;*
- *new business models;*

- *new manufacturing engineering;*
- *emerging manufacturing science and technologies; and*
- *transformation of existing RTD and educational infrastructures*

"Manufucture" has also contributed to establishment of *European Factories of the Future Research Association (EFFRA)*, a PPP which was launched in 2009 and whose goal is *to help the EU manufacturing enterprises, in particular SMEs, to adapt to global competitive pressures by improving the technological base of EU manufacturing across a broad range of sectors*[79]. Currently, 61 ongoing projects and supported by both European industry and the EU within the FP7. Public funding will continue under Horizon 2020. The roadmap for 2014-2020 "MANUFUTURE" developments was issued in November 2012. According to this roadmap a strong focus should be on sustainability, people (both employees and customers), and structures of value chains in order to keep Europe at the forefront of world's manufacturing leadership. With this background, the roadmap has identified the following prioritized research areas

- *Advanced manufacturing processes*
- *Adaptive and smart manufacturing systems*
- *Digital, virtual and resource-efficient factories*
- *Collaborative and mobile enterprises*
- *Human-centred manufacturing*
- *Customer-focused manufacturing*

The *Networked European Software and Services Initiative (NESSI)* was launched in 2004 and engages industry, SMEs, academia and users to ensure Europe's leader position in software and IT services in an environment fast changing by globalization and technological innovation. To achieve this goal the NESSI also contributes to improvement of competitiveness position of European transport industry. In collaboration with technologies promoted by other ETPs (i.e., ISI, Photonics) the development of Intelligent Transport Systems will also enable more efficient trip management and Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communications. The challenge regarding transportation will consist in ensuring safe and high-quality access to all types of internet information.

Photonics 21

This ETP was launched in 2005; it synthesizes several disciplines related to photons including optics, material science, electrical engineering, nanotechnology, physics and chemistry. A study prepared for the EC (Butter et al. 2011) identifies markets for photonic technologies, to which producers of vehicles, aviation sector, and administrators of road, rail and logistics infrastructures also belong. Possible applications of nanophotonics in transport industry are metamaterials such as car radars, sensors, road safety monitoring systems, road monitoring and vehicle tracking. Photonics will also contribute to development of new low energy lighting, solar panels for energy supply in spacecrafts and in V2V and in-vehicle communication. Manufacturing processes may gain in quality and become more sustainable through laser and photonics technology because they reduce chemical waste and energy consumption. Efficiency improvements by photovoltaic devices

[79] European Commission, Research and Innovation, Industrial technologies, accessed March 26, 2013 http://ec.europa.eu/research/industrial_technologies/factories-of-the-future_en.html

relevant for automotive industry consist in capacity enhancement for energy storage (e.g., for electric cars and lightweight vehicles). The ETP also engages with other platforms whose work is also relevant for competitiveness of European transport industry such as ARTEMIS, eMOBILITY, ENIAC, EPOSS, ERTRA, EUROP, ISI, Manufuture and NESSI.

ALICE (Alliance for Logistics Innovation through collaboration in Europe

The recently launched ETP (11 June 2013) , like other ETPs, aims at developing a SRA. ALICE goal is rising innovation and market deployment of logistics and supply chain management in Europe with the involvement of several stakeholders. The platform will support Horizon 2020 and by promoting an innovative logistics and supply chain management links the transport and the industry efforts in searching for common fields of action in which both can complement and enhance each other. Its relevance for the competitiveness of the European transport industry is paramount since as the EC reports: "*it is estimated that logistics account for 10 to 15% of the final cost of finished goods"* and further *"a 10% to 30% improvement in efficiency in the EU logistics sector would potentially equal a € 100 – 300 billion cost relief for the European industry*" [80].

7.2 Impacts on Transportation Industry

It has proven very difficult to find impacts on the transport sector and even more difficult to find them for specific transport industries, either manufacturing or service and/or referred to a certain transport mode. Nevertheless we consider the following general effects of the policies described above can be relevant for the competitiveness of the European transport industry. However we would like to note that, unless otherwise specified, the impacts are not related specifically to the transport sector.

Impacts of Foreign Direct Investment

Inward FDI

Business–friendly policy and other factors facilitating business development (along well educated and productive workforce, and large market capacity) attract foreign direct investments (FDIs) to a given country. The effects of inward FDIs – a major goal within the EC's industrial policy (EC 2010/C614) – for the recipient country are generally positive because they increase capital stock and production base, create employment, bring new technologies, and managerial knowhow. Although we are most interested in the impacts that FDI policies may have, we would like just to provide a brief description of inward FDI to help understand the context. The following are some highlights:

- Both EU intra and extra FDI outflows contracted between 2007-2010, but specially intra FDI outflows, the latter mainly due to the crisis but also as a natural adjustment after the increase due to EU enlargement
- Extra EU FDI inward flows have concentrated (US and EFTA, out of them mainly from Switzerland)

[80] European Commission, Research and Innovation, Transport, News. European Technology Platform on Logistics ALICE launched. accessed August, 15 2013 http://ec.europa.eu/research/transport/news/items/alice_lauch_en.htm

- Japan's FDI in Europe has declined
- Inward FDI flows from emerging markets into the EU are gaining weight, especially those from Western Asia.
- China and India are profiling themselves as important green field investors

According to the European Competitiveness Report (EC 2012 c) the automotive and the transportation equipment manufacturing industry account for only a slightly more than 3% of European inward FDIs. When compared to other industries, it is quite low, especially when taking into account the industry's high degree of internationalisation and its importance for the EU external trade. However, when comparing the inward FDI flows to the scope of value-added, the non-EU firms account for the entire 12.2 % of the EU value-added in that industry.

Table below presents the policy related factors that may positively or negatively impact on attracting FDIs (in cursive and blue those which are not statistically significant) as well as the generated effects that FDIs may bring out to European firms.

Table 7: Factors that influence FDI and impacts on European companies

Policy related factors that influence FDI		
Trade policies and trade agreements	+	
Regional integration (including the introduction of the Euro)	+	
Investment promotion agencies[81]	+	
Costs of starting a business		-
Unit labor costs (especially in the EU-15 and labour taxes (only in the EU-12)		-
Corporate taxes for greenfield FDI		-
Investment in education and training	+	
Transport and ICT infrastructure	+	
Financial incentives and grants (like tax holidays for first time investors)	+	
Average number of years of professional education	+	
Double taxation agreements (DTA)	+	
Investor protection	+	
Labour market flexibility	+	
Intellectual property rights	+	

Impact on European firms of inward FDI
• Stimulate technical efficiency of local firms by providing assistance, acting as role models and intensifying competition and technological upgrading possibly due to the use of technological licenses • Provide European goods and services with access to export markets • Good practices for host country firms • (Un)intended technological, skills, management techniques and knowledge transfer through reverse engineering, imitation movement and/or training of workforce • Increase labour productivity of suppliers (in the manufacturing sector), international trade and geographically distributed value production networks • Increase managerial, technical, organizational and marketing innovation at both the target industry companies and their suppliers (or the other way round) • Stimulate establishment of sub-contractor and spare parts and subsystems suppliers, and international commerce • Stimulate employment at local suppliers • Positive horizontal spillovers on productivity • Facilitate re-investment of proceeds in the host country • Foster long-term investment horizon in host country • Facilitate fire-and-hire policy and wage differentiation easing workforce adjustments and worker mobility • Increase patent royalties and other intellectual property revenues • Possible negative horizontal spillovers due to market stealing

Source: EC. 2012. The European Competitiveness Report 2012. *Reaping the Benefits of Globalization*. Brussels: European Commission[82] and also own studies of positive short- and long-term impacts of FDI on the receiving countries.

According to the same report (EC 2012 c) investment promotion agencies (IPAs) may become less significant in high income countries. In addition, impacts induced by labour, education and the levels of corporate taxes vary between the different Eurozone countries (EU-10, EU-12, EU-15). Further, the types and scale of impacts that corporate taxes exert on the host countries will also

[81] It is worth mentioning that the aerospace and automotive are often prioritised by IPAs.

[82] The report classifies factors into policy framework, economic determinants and business facilitation factors. We have opted for choosing those related to the policies described in this and other chapters of our deliverable

depend on the types of FDIs (green field, M&A, financial and/or manufacturing investments) to be attracted. The quality of education is more important that the quantity. Therefore, the number of years the future workers spent in education is not so significant, although there is a positive correlation between the latter and FDI inflows.

In general, presence of foreign firms may increase labour productivity. But, the level of employment in Europe-based industries may not rise automatically nor may immediately produce benefits for the all collaborating companies. As we see from the table above, it depends on whether the foreign and domestic companies interact vertically or horizontally. Besides, the size of the local companies, their "absorptive capacity", and the technology gaps between the domestic and foreign firms in the different subsectors may also influence the scope, the intensity and the level of FDIs gains. The upstream domestic suppliers who benefit most may be those who initially are more productive and grew at faster pace, but also may also encompass smaller firms with wider labour productivity gaps vs. their foreign investors.

The scale and duration of gains from innovation such as positive spillovers through backward linkages (new products, product and/or process innovations) will also depend on whether the firms are involved in export activities (much larger for non-exporting firms), their size (more significant for those with 25 or more employees), the scope of productivity gaps (the lesser the better) and the relative labour productivity (the higher the better). In 2004, a survey of local companies in EU-10 operating in transport services recorded a relative higher than average share (24%) of domestic sales to multinational enterprises.

Pursuant to the above, the innovation fostering policies should encourage formation of networks and transfer of technology between the local and multinational firms, as well as harmonization of national taxation level. However, the agreement on the latter still remains politically quite controversial.

Outward FDI

To give some context and according to the same study mentioned above (EC 2012 c), some of the most relevant characteristics of outward FDI have been the following:

- Extra FDI outflows contracted between 2007-2010, but despite of it, its global share increased (mainly thanks to extra EU outflows importance) and EU-27 outward FDI (including intra EU) accounts for more than half of total global FDI outflows
- The shift from intra-EU to extra-EU FDI outflows might indicate that EU MNEs have perceived the EU as a less attractive location for FDI since 2008.
- Main destinations of EU FDI outflows are US and the EFTA (holding more than half).
- Investment by EU MNEs in developed destinations (in which M&As are dominant) has generally declined while emerging economies, mainly in Asia and South America have become more important recipients for EU FDI and generally show more resilience to the crisis and are ideal targets for greenfield investments.
- Although neighbourng countries benefit from EU FDI outflows, this is not the case for North Africa
- EU companies hold a larger share of inward FDI stocks than US or Japanese in many countries (India, Argentina)

- excluding the financial sector and the activities of holding companies, services account for 29% of total EU outward stocks and manufacturing industries account for 50% of extra EU outward flows. But in neither of them transport industries seem to have a major role

The positive effects of market expansion arising from getting closer to customers, reduction of production costs through value chains specialisation, access to natural resources and/or more advanced technologies/knowhow (as compared to national assets) are better visible at individual company level. In case when the home-markets affect the employment, technology transfer, productivity and the skills, the profitability of outward FDIs will depend on the motive, the relationship between the parent company and its foreign affiliates, the home country economic and cultural features and also how the European transport industry determines its own competitiveness. Table below summarizes the positive and negative impacts of outward FDI.

Table 8: Positive and negative impacts of outward FDI at company and country levels

Positive impacts of outward FDI at firm level	Negative impacts of outward FDI at country level
• gaining and securing market access • reducing production costs by specialisation along the value chain • gaining access to natural resources • gaining access to advanced technologies/knowhow • increase in productivity at home as a result of increased international pressure • increase long-run profitability for MNEs • development of new products or models tailored to external market demand • bringing home innovations applied by external suppliers, subcontractors and competitors • learning new market demands and business practice	• job-exporting (this issue is also present at intra EU level-eastern enlargement), specially of low-skilled workers • leaking out of innovation through internationalisation of corporate R&D, outsourcing and off-shoring • exposure to local red-tape and bureaucratic barriers, and sometimes (negative) national sentiments • high-adaptation costs to new work culture and business environment • higher business risk due to reliance on local business service providers (banking, auditing, training, and taxation)

Source: EC. 2012. European Competitiveness Report 2012. *Reaping the benefits of globalization*. Brussels: European Commission and from other studies (Johanna has references)

The capacity for attracting FDIs has also facilitated uptake of new technologies by the technology driven industries (such as automotive) in countries with prior little technology experience. This might facilitate outsourcing of manufacturing and/or other commercial activities from well-established EU companies to the newer EU members (e.g., establishment of new Mercedes Benz plant in Hungary).

Results reported in the same study (EC 2012 c) confirm that MNEs in EU-15 are "*larger, employ more capital per worker, pay higher wages and are more productive than domestic firms"*, and that these advantages underlay the firms' selection for FDIs. According to results, the size and the capital intensity of firms have stronger effects than productivity and the share of intangible assets. The fact that European firms are investing abroad could be interpreted as a sign of competitiveness but going global won't necessarily make all firms more competitive. With this in mind, the FDI policies should focus rather on creating vibrant competitive market environments than on subsidizing foreign affiliates and/or offering them a targeted support. As the report indicates several paths can be chosen for such policy actions

- Favour those factors that support decisions to invest abroad (for instance the size: allow firms to grow),and
- Find out motives for not investing abroad (inability to get sufficiently good knowledge on foreign markets, operational uncertainties, and management failures), and fight them

Brief description of trade relations and revealed comparative advantage

The same study on the competitiveness of the European industry (EC 2012 c) revealed that EU's comparative advantages (RCAs) reside mainly in technology-intensive manufacturing industries such as the vehicles industry whereas the supply of services produces comparative disadvantage, especially in knowledge-intensive industries.

The EU strong revealed comparative advantage in high- and medium-high-technology industries such as automotive is highly visible in trade relationship with RIM[83] countries. However, the competitive advantage of high technology industries disappears in business deals with EFA/EFTA countries and Israel. The following table provides some information regarding the relative trade balance and RCA for selected countries and regions.

[83] Republic of Albania (Albania); People's Democratic Republic of Algeria (Algeria); Republic of Armenia (Armenia); Republic of Azerbaijan (Azerbaijan); Bosnia and Herzegovina (BiH); Arab Republic of Egypt (Egypt); Georgia; State of Israel (Israel); Hashemite Kingdom of Jordan (Jordan); Kosovo under UN Security Council Resolution 1244 (Kosovo)109; Lebanese Republic (Lebanon); Libya; Principality of Liechtenstein (Liechtenstein); Republic of Moldova (Moldova); Kingdom of Morocco (Morocco); Kingdom of Norway (Norway); Occupied Palestinian Territory (Palestine); Russian Federation (Russia); Republic of Serbia (Serbia); Swiss Confederation (Switzerland); Syrian Arab Republic (Syria); Republic of Tunisia (Tunisia); and Ukraine

Table 9: Relative trade balance and RCA of specific countries

2010	Relative trade balance		Revealed Comparative Advantage		
	Motor vehicles, trailers and semi-trailers	*Other transport equipment*	*Motor vehicles, trailers and semi-trailers*	*Other transport equipment*	*Transport Service industry*
France	-0,05	0,29	0,25	1,07	1,21
Germany	0,4	-0,03	1,15	4,13	1,14
Italy	-0,15	0,26	0,73	0,93	0,24
Poland	0,25	0,13	1,67	1,06	1,31
Slovakia	0,28	0,4	2,28	0,28	1,5
Spain	0,16	0,17	2,19	1,07	0,83
Sweden	0	0,15	1,05	0,39	0,75
United Kingdom	-0,17	0,08	1,25	1,61	0,6
EU -27	0,11	0,1	1,28	1,21	1,04
USA	-0,32	-0,43	1,01	0,44	0,63
Japan	0,79	0,56	2,16	1,32	1,34
Brazil	-0,14	-0,01	1,08	1,42	0,76
China	-0,17	0,4	0,25	0,88	0,97
India	0,27	-0,13	0,41	1	0,52
Russia	-0,89	-0,07	0,09	0,67	1,62

Source: EC. 2012. European Competitiveness Report 2012. *Statistical Annex.* Brussels: European Commission

Beyond the firm-targeted policies mentioned under the impacts of FDI, the fostering of trade and FDI and support for liberalisation process can also improve business conditions in countries who are recipients of EU outward FDI flows, and especially the RIM countries.

Impacts on SMEs

According to a recent public consultation (EC 2013 g)[84],the most burdensome legislative acts affecting SMEs were related to transport of goods in general, provision of international services and recognition of professional qualifications. Other bothersome policy areas included taxes (direct and indirect), custom controls and formalities, environment protection requirements (special treatments of waste, and chemicals), product safety requirements (labeling obligations, demonstrated conformity with national laws in absence of EU harmonised and CE-marking rules), employment and social obligations (mainly linked to health, safety and working hours rules and obligations), and public procurement. IPR, energy efficiency and consumer protection regulations were among the less frequently mentioned. In the consultation respondents were also asked for reporting revisions of laws that already have had or are expected to have positive effects, but the result obtained show that these were very few and none of them included the legislations identified in this deliverable.

[84] The consultations involved 779 SMEs, 154 representative organizations and 67 other stakeholders, mostly located in the EU (although approximately 13% of respondents were from non-EU countries, fore mostly Turkey). The feedback obtained from the EU based firms and associations was, however, not compiled from all member countries.

Another study on the *opportunities for internationalization of European SMEs* (EC 2011 d) interviewed the managers at SMEs participating in 13 different support measures, of which three were at European level (the Executive Training Programme (ETP), the Gateway Programme to Japan and the Gateway Programme to South-Korea) as regards programmes' effects on business activities in target countries. Although the overall results do not discern between effects achieved due to the support measures and others due to specific individual characteristics, some valuable information can be extracted with regards to business internationalisation and strategic management skills needed for market expansion:

- Knowledge of availability of the Gateway Programmes (GP) for Japan and Korea took place through a wide range of channels such as through direct contact with programme representatives, e-mail or telephone, or through private consultants. In general European institutions and programmes and the (European) chamber of commerce were important sources of information on ETP and Gateway Programmes;
- Participants in GP differed from participants in other schemes with regard to services they used. On average 71% per cent of all programmes and support measures are used to enhance the participants' export activities while the share of participants that use the Japan and Korea GP for exports is 81% and 88% to, respectively. Additionally, the GP to Japan, although not that often used, seemed to aid relatively more cases of development of license or franchise agreements.
- The GP for Korea scored highest on overall satisfaction rate (0.85), on quality and relevance of the information (average 0.74, Gateway 0.92), experience of advisors (average index 0.65, Gateway 0.88), and usefulness of advice (average 0.64, Gateway 0.85). In fact, over 40 % of the firms "*would not have started business activities without this support"*.
- The GP for Japan helped many businesses to increase the scale international business activities.
- Oppositely, participants of the ETP scored high on *"not immediate effects"* and the overall programme scored low on accessibility of support measures.
- With regards the intermediate effects, the GP for Japan scored highest on supporting participants in *"increasing the knowledge on how to enter new markets"*, while the GP for Korea scored highest on "*meeting customers/partners that otherwise would not have been met"* and on *"making a better assessment of tangible business opportunities in target markets".*
- Both programs scored quite high on administrative efficiency, marketing and accessibility of measures.

Even if among the surveyed only 5% were firms whose main activity was transport, travel agencies, post & communication and 2% whose main activity was sale, maintenance and repair of motor vehicles (EIM 2011), we believe that these measures – by aiding the most vulnerable business entities with knowledge and necessary support for going international, produced an overwhelmingly positive impact on the entire European industry, also on transport sector.

Another European study on the Internationalisation of European SMEs (EIM 2010) [85]describes internationalization as all types of activities that put SMEs into a meaningful business relationship with a foreign partner (exports, imports, foreign direct investment, international subcontracting and/or technical co-operation). This study[86] analysed 26 separate sectors and included 381 interviews related to sales of motor vehicles and 477 to transport services. Both were sectors with highest percentage of internationalized SMEs whose share of international business accounted for about 68% and 60% respectively. Over 50% of SMEs were engaged in export of motor vehicles while about 45% in import. About 28% of SMS participated in either FDI or technical cooperation or foreign subcontracting. Within the transport sector 39% of SMEs were involved in exports, 26% in imports, over 20% acted as a subcontractor to foreign firms, and over 20% had foreign subcontractors. These relationships together with FDI and/or technical cooperation were performed by about 37% of SMEs in transport sector. The major exporting region for SMEs in the transport sector is Europe itself. However, much more of SMEs as compared to other sectors also export to North America (38%), Russia (31%), Middle East (30%), China (30%), Brazil (29%), North Africa (28%), India (27%), Japan (27%), Australia and New Zealand (26%). Still some other firms export to regions in South and Central America (33%), Asia (28%) and Africa (27%). The main import regions outside Europe from which the imports are sourced were China (37%), North America (33%), and Japan (24%). The study also describes which barriers perceive SMEs as the most obstructive when internationalizing. Unfortunately, these barriers are not sector-specific. Transport itself has been distinguished as a major barrier because of its highly politicized role in many countries. As the quality of transport is a major socio-political component of national growth, it highlights the relevance of the entire transport sector for development of transport industry, and also for many SMEs in other sectors. The price of products and services offered by SMEs and the high cost of internationalization are perceived as important internal barriers, especially by those who are not yet active in international markets. This difference points an information deficit among those who have not made the step yet. Among the external barriers, lack of capital and lack of adequate information, followed by the lack of adequate public support and costs and/or the difficulty of paper work are the most important barriers for SMEs in non-EU markets.

According to the study, though, just 13% of SMEs within the transport service sector and 20-25% within manufacturing industries (unfortunately not sector specified) are aware of existence of public programmes supporting internationalization. This might explain the low use of these programmes by internationally active SMEs; only less than 1% of them used financial support and less than 2% other measures. This indicates that the policies aimed at supporting SMEs in internationalization of their business have not yet reached many firms within the transport sector. However, such policy measures seem to be quite new and expanding so it is not possible to assess whether these levels have changed recently. Anyway it seems to be a need for increasing efforts to enhance this awareness and promote the use of public support programmes and facilitate access to support

[85] The data and conclusions are based on a survey of 9,480 SMEs in 33 European countries conducted in spring 2009. The study also includes non-EU members from Croatia, Iceland, Liechtenstein, FYROM, Norway and Turkey whose share of SMEs in the most internationalised activities was slightly higher than those from the EU.

[86] The study also reveals that the scores depend on perception of respondents of what they consider exporting activities and that it may differ from survey definition. For example hotels serving foreign tourists and businessmen may be considered to be 'exporting' following the Eurostat's definition, but this is not likely to be perceived that way by all respondents.

measures. In order to have broader impacts on SMEs, the availability of internationalization supporting programmes and other industrial policy measures should be better advertised and disseminated using the European and national official communication sectors but also social media. Other policy recommendations related to SMEs in general and not sector-specific also involve:

- support of innovation to spur internationalisation since there seems to be a positive link between these two
- focus on both imports and exports, since most SMEs start with importing activities when introducing themselves to international markets
- foster e-commerce because online services seem to help SMEs to overcome barriers to internationalize
- foster closer cooperation between MS in collecting market information

Public procurement

Although public procurement mainly aims at heightening the efficiency of public resources, still the outcomes of a study (EC 2011/S853) which evaluated how the Directives (2004/17/EC and 2004/18/EC) imposing new rules on public procurement affected the effectiveness of public procurement, showed that these were also relevant for the entire industry, including the transport sector. By investigating how much the utilities sectors' exposure to competition has changed in the aftermath of new regulation, (since the previous lack of competition created a rationale for Utilities Procurement Directive), the study has assessed whether, and if so, how much the procurement transparency and cross-border rivalry have increased. The results confirmed that implementation of public procurement directives increased openness and transparency within the procurement market, and that this has led to higher competition level.

Integration of other goals (environmental sustainability, social considerations or innovation) beyond the former targets (increase public resources efficiency through more transparent and cross-border competition) may also affect the competitiveness of transport industry, despite the fact that due to insufficient monitoring, it is still difficult to assess how far this integration has progressed. Nevertheless, it seems that sustainability issues are incorporated whenever feasible (though in different manners between and within the MS), while adoption of more socially responsible practices and integration of innovation into procurement process is less extended. This integration partly reflects in the fact that 70% of the contract notices (80% in terms of value) use the economically most advantageous tender criteria rather than the lowest price.

In general, thus, the direct cross-border procurement has not evolved as expected. The most frequent reason is the lack of experience in doing business abroad. This may also indicate the incapability of SMEs in European transport industry to go global. The language skills and legal barriers as well as existence of too much local competition are also named as important barriers. The findings of the evaluation were helpful to develop the two current proposals to review the existing directives whose implementation shall make procurement procedures more flexible as well as facilitate access, especially for SMEs.

Annex 9 of the same study (EC 2011/S853) gives some more information regarding specific sectors and discusses whether the circumstances regarding liberalization and competition have changed since the introduction of Utilities Procurement Directive in different sectors including railways, and airport and ports sectors. The rationale for this evaluation is not to measure the impact that public procurement has exerted on liberalizing and/or increasing competition in the target sectors, but rather the opposite, to assess the actual degree of liberalization and competition in order to subsequently adapt the public procurement legislation to the current status (including or excluding certain service sectors). The study provided insights into how far the different sectors have developed as regards liberalization (removal of legal, regulatory barriers or provision of access to critical networks), openness to competition (take up the legal opportunity created by liberalization), privatization of incumbents (through increasing their responsibility to shareholders, making them more disciplined, efficient and competitive), and finally, introduction of sector-specific regulations (e.g., tariffs). The results available will be reported under each transport mode (see following subchapters) but the general conclusion of the study is that the rationale for implementing public procurement directives is still valid for the port, airport and rail sector, and that competition level alone does not provides sufficient grounds for considering competition exemptions[87].

Another study (Strand et al 2011) also shows that on average 5.4 firms compete for each public tender. However, the respondents (both the procuring authorities and the supplier firms) surveyed believed that private procurement became more efficient because it is faster (108 days in average for public procurement) and less costly (it takes 38 person days in average to complete a public procurement contract). Still there are great differences across Europe as regards costs, time consumption and number of bids. A smaller number of respondents also considered that public procurement under the national regulations (under the thresholds) is less time consuming that over the thresholds, i.e., regulated by European directives. The share of cross-border of overall procurement is relatively small (3.4%) with small countries having the larger proportions.

Table below presents the share of the number of procedures and its value within activity of government (procedures) and techniques in transport-related sectors according to the results published in the study.

[87] According to the Commission's website, specific utilities markets may be exempt from public procurement rules if it can be proved that the legal/regulatory environment permits access and competition in the sector and the utility operators in the market concerned are subject to competitive pressure. Source: European Commission/Internal Market/Public procurement, accessed May 03, 2013 http://ec.europa.eu/internal_market/publicprocurement/rules/exempt_markets/index_en.htm

Table 10: Share of purchases in terms of number and value (number/value) of the different procurement procedures and techniques in transport-related sectors.

	Procedures				Techniques	
	Open	Restricted	Negotiated	Negotiated w/o competition	Framework agreements	Joint purchasing
Ports	57 / 84	10 / 10	28 /6	5 / <1	9 / 2	4.6 / 8
Airports	46 / 51	3 / 3	43 / 41	8 / 6	10 / 10	-/ -
Urban transport	40 / 45	10 / 10	43 / 41	6 / 3	10 / 9	-/ -
Railways	37 / 31	7 / 13	43 / 46	13 / 10	16 / 22	-/ -

Source: Strand I., Ramada P. and Canton E. 2011. Public Procurement in Europe. Cost and Effectiveness, p. 55 and 57. PwC, London Economics and Ecorys[88]

Other relevant findings indicate that:

- Airports and ports authorities receive most of the bids with airport authorities (estimated) to receive even more bid when assessed by regression analysis
- High incidence of cross-border wins in ports, railway, airports and urban transport sectors
- Bidders for airport procurement contracts, but especially those offering their service and products to port sectors are exposed to high foreign competition.
- Urban transport, railways, port and airports belong to the sector where the procedures take the longest. However, procurement procedures in urban transport and railways are estimated to take lesser time.

A further study (Kahlenborn et al 2011)[89] reports that, Green Public Procurement (GPP) is increasing thanks to both the specific and non-specific procurement policies. Transport is among the most prioritized product groups to which MS apply GPP criteria influenced by the EU policy. Transport also holds one of the largest shares of GPP-affected national budget, which according to the study, is high enough to exert market impacts. GPP involves often some kind of socially responsible public procurement (SRPP) for which no specific products seem not yet to be assigned. Last, when it comes to public procurement promoting innovation (PPPI), PPPI is often linked to GPP product groups to which transport also belongs although most MS do not systematically prioritize particular product groups for innovation procurement. Generally monitoring public procurement and related expenditures remains low, especially with regard to integration of sustainable, social and innovation practices. According to the same study, applying for tenders integrating the green, social and the innovation criteria requires more efforts and more financial and human resources than traditional bidding, especially for SMEs. Labels, third-party audits, verification of the supply chain and general paperwork increase the administrative burden. Social

[88] According to the study this information is "*largely based on the TED database (i.e. a web portal of the Supplement the Official Journal of the EU) maintained by the Commission which contains detailed information on about 540.000 individualpurchases by authorities in 30 countries over the 2006-2010 period".*

[89] The study reviewed the EEA Member States' experience as regards integrating other policy considerations (green, social and innovation) into procurement policy and practice. It also included results from some interviews with suppliers although the information solicited through the latter was not based on a regular survey and this should be therefore *„ treated rather as anecdotal evidence"*

requirements regarding foreign suppliers are especially time-costly, though the most significant part of the administrative burden relies on environmental requirements since these are the most frequent. However, there are also some positive effects derived from this additional work. It gives companies more information on their own production processes which can be used to become more efficient or as promotion marketing material. It also increases the sustainability awareness within companies. The reason why the scope of compliance burdens increases is lack of homogeneous and coordination for standardization of procurement processes, which again, are caused by insufficient training and work guidelines. Lack of training of procurement officers is especially negatively affecting innovation-promoting tenders. As they are not informed about innovative product categories, the focus on low price often prevails over demand for innovation, thus preventing companies from selling new products and instead, supplying the cheapest items. Additionally, rapid policy changes (for instance due to the economic downturn) and inconsistency between the different criteria also hamper purchasers to look for more novelties in the long-term and early adoption, which enhances the risks of investments in innovation production.

Last (with regards to public procurement) table below summarizes business impacts exerted by options related to modernization of public procurement procedures as reported in the impact assessment accompanying proposed legislation on public procurement (EC 2012/S1586).

Table 11: Expected impacts related to the modernization of public procurement legislation.

Targeted adjustments to current scope of public procurement legislation such ashHigher threshold for social services, with a special regime for social services above this threshold and inclusion of all former B-services (except for the above) in the regular regime.
Identify valid opportunities, increase the consistency across the EU and increased transparency requirements Key: clarity and confidence between works and services or mixed services/works contracts
Far-reaching changes to scope of the current rules involving exclusion of entire groups of purchasers or transactions (raise the thresholds)
• Reduced visibility of opportunities (due to the fact that a series of contracts would no longer have EU-wide advertisement) which could – positively impact incumbent firms by lowering the level of competition but also, – Reduce the participation of other firms, especially foreign ones and SMEs for which it would be more difficult to find those opportunities • Probable drop in rates of cross-border bidding • Increased market entry barriers for SMEs
Correct and enhance existing procedures (Improve tools for repetitive purchasing and increase use of electronic communication tools)
• Repetitive purchasing arrangements may close the market, particularly to SMEs • Electronic communication tools may create savings and reduce the costs of procedures for all types of suppliers as well as increase transparency Key: need to build in safeguards to ensure that wider use of repetitive purchasing arrangements is not abused and overcome learning costs to benefit from electronic possibilities
Expand menu of procedural options available to public purchasers and alleviate procedures where they result in disproportionate costs (greater freedom for CAEs to use negotiated procedure and new lighter publication regime for sub central authorities
• Address more efficiently the needs of CAEs and secure better terms for their delivery as prices

negotiated are higher

- Transact more easily with sub-central CAEs but also reduce procedural guarantees and remedy procedures available to suppliers in the event of problems

Key: appropriate contracts design shall avoid depriving suppliers of access to information

Enable CAEs to frame procurement needs in ways that integrate other policy goals (allow inclusion of LCC and technical specifications and introduction of the Introduce the "Innovation partnership")

- More sophisticated and demanding procurement specifications from public authorities
- Direct costs for suppliers due to the acquisition of labels/certificates to demonstrate compliance

↓↓

Development of their capacity to respond to these demands contributing to a transition towards superior technologies	Exit these markets and focus on supplying less demanding purchasers (eventually re-entering them again after a period of transition)

Key: operating environment (standardization of requirements)

Remove discretion from CAEs: they must award (all or part) contracts on the basis of performance in respect of other policy goals (quotas and use of defined award criteria)

Market exclusion for certain business ↔ Extensive investment of certain business

Key: framing the award criteria according to the feasibility of the supply side. Otherwise there is a danger ofOver-specification of criteria and of excluding certain suppliers from the market

Remove administrative barriers to SME participation and cross-border access (mandatory acceptance of self-declarations as prima-facie evidence for selection and introduction of the European procurement passport)

Reduce administrative burden and simplify procedures, reduce uncertainty and speed up ability to bid, fewer translation costs.	→ encourage greater participation in public procurement contracts

Key: revised tools to enhance transparency, improved e-Certis

Prescriptive measures to reserve parts of public procurement markets for SMEs or require structuring of purchases in way that favours SME participation

Mandatory division of contracts into lots: lower the typical value of a single contract and improved access of SMEs	Quotas: increased SMEs shares in the public procurement market but decreased cost-effectiveness of procedures due to additional documentation requirements	Obligatory subcontracting of contracts: increased competition for SMEs as subcontractors, but a disadvantage as prime contractors

Leverage achievement of economies of scale and optimal outcomes for CAE through the use of specialised, professional bodies which aggregate purchasing where appropriate.

Less transparency and fewer publication may decrease competition and access

Lower procedural costs for firms, economies of scale

Key: Dynamic Purchasing Systems (DPS) combine benefits of aggregation with open competition

Oblige MS to identify a national authority in charge of implementation, control & monitoring of public procurement which reports annually on performance

Professional procurement and stronger anticorruption measures may increase transparency, legal certainty and confidence, reduce friction, complexity and the costs, and increase the competition

Source: EC. 2012. Commission Staff Working Paper Impact Assessment accompanying the document Proposal for a Directive of the European Parliament and of the Council on Public Procurement and the Proposal for a Directive of the European Parliament and of the Council on procurement by entities operating in the water, energy, transport and postal sectors. Brussels: European Commission

State Aid

According to (EC 2011 v) the amount approved by the Commission within the Temporary Framework (€ 81 billion) was not fully utilized. In fact only a quarter of it was used, being the most frequently used the 500.000-per- undertaking- measure which was mostly use as working capital support and which in some MS was restricted to SMEs.

However, in general it is difficult to assess the effects of State aid separately from other measures such as liquidity interventions by the European Central Bank or fiscal stimulus, and even more difficult to analyze them for specific sectors. Keeping this in mind the study reports that corporate investment has been supported not only by state aid measures dedicated to companies (i.e. 500.000-per-undertaking measure) but also by public interventions to support the financial sector, which have helped to stabilize the financial market and prevent its collapse, even if risks have been reduced there are concerns about the sustainability of such measures regarding stability in a long-term perspective. It also reports that State aid measures helped banks to improve their balance sheets which in turn enable them to ease credit standards and thus facilitate firms access to credit, which was especially hard for SMEs since they did not have the possibility to turn to other credit facilities (such as issuing bonds).

Bond Initiative

Expected outcomes of the initiative are attracting more final funding at lower cost, stimulation of larges infrastructure projects with national and cross-border benefits, increased access at a reasonable price, diversifying the financial possibilities and positive effect on growth and competitiveness of the EU, as well as social and environmental benefits mainly derived from economic growth and the possibility to finance projects which otherwise would not have taken place, as it is specified in the *impact assessment* (EC 2011/S1239).

According to the results of a public consultation on the Europe 2020 Project Bond Initiative[90], 60% of stakeholders think that the chosen mechanism is likely to attract private sector institutional investors to transport, energy and ICT sectors. However, 131 respondents representing different professional associations/networks, banks, governmental bodies, operators and financial intermediaries also expressed the need for making the procurement process more flexible. They have also voiced concerns about some regulatory issues that possibly may prevent them from investing in longer-term, lower-rated assets (Solvency II) and higher risk weighting due to the Capital Requirements Directive under which some bonds could be classified depending on their structure.

Research impacts and networks and Public Private Partnerships' effects on industry

(Wiesenthal et al. 2011) points out that data scarcity does not allow to analyze the public (and private) efforts as well as to monitor the progress towards policy targets, but nevertheless it gives an

[90] European Commission's website, http://ec.europa.eu/economy_finance/consultation/pdf/summary_en.pdf. Accessed June 3, 2013

overview with regards to public funding at EU level, limiting the scope of the later to FP7 R&D investments. In 2008, public R&D investments amounted to roughly one tenth of corporate R&D investment in transport. EU MS contributed for € 3.6 billion, and the EU funds through FP7 allocated to transport related R&D on an annual basis accounted for € 0.6 billion. If compare to corporate R&D investment €39.4 billion, EU public support is quite low. The following table gives an overview of the size of EU FP7 funding within total R&D investments for each sector (only manufacturing and suppliers, no service providers, ITS companies of infrastructure construction investments are included):

Table 12: Weight of EU FP7 funding with respect to total R&D investment

	Automotive	Civil aeronautics	Rail	Waterborne
Total R&D	33,3	6,3	1,2	0,9
EU FP7	0,1	0,3	0,03	0,1

Source: Wiesenthal T., Leduc G., Cazzola P., Schade W., and Köhler J. 2011. Mapping innovation in the European transport sector. Luxembourg: European Union

Although public R&D expenditures are generally more evenly distributed across modes than corporate R&D investments, the aviation sector accounts for the highest share of EU FP7 funds. Within the automotive sector most of public funding was dedicated to "radical technologies". For these technologies public support *"can reach up to 40% of total funds … compared to less than 5% of the whole automotive R&D investment"*. The study also reports that direct public support can also support high-risk innovations that require high capital investment whereas regulatory and fiscal policies are identified as a main driver to innovation because they can stimulate the adoption of innovative technologies and transform markets. Besides, they can contribute to improve quality, increase market shares, facilitate entry into new markets and reduce costs in the production process. Furthermore, ETPs are given as an example to align public and private investment efforts and contribute to speed up agreements on standards and technical specifications as well as to overcome the institutional lock-in, giving companies more confidence to invest because they provide with a certain level of predictability. ERA-NET is also given as an example supporting those goals and contributing towards turning heterogeneity into synergies. Such efforts are also complemented by JTIs. The report also draws attention to the fact that, although initiatives are normally align along transport modes, they can contribute to increase efforts across modes. All together ERA-NETS, ETPS and the JTIs are helpful to coordinate research across Europe, and standardization-policies can help integrating fragmented transport systems into interoperable ones as well as integrating fragmented markets to reduce costs and administrative burdens.

The m*etrics and success criteria for ARTEMIS*[91] (ARTEMIS 2011) results show that the expected market impact of research results may generate applications that will be commercially introduced within a period of 2-5 years after a given project completion. According to the respondents, the effects of such applications shall mainly reduce the product/service development costs and foster

[91] The report is based on the responses received by 25 industrial and 9 university partners as well as 1 consortium (all participants of projects under ARTEMIS 1st Call) to a multiple choice questionnaire with open-ended questions.

consumption of future products. However, results also show that for this to materialize, product industrialization, deployment of new solutions and intensive users training will be essential.

The *Factories of the Future Public-Private Partnership Roadmap* (EFFRA 2012) lists the following expected impacts of the PPP Factories in future industries

- increase capability for manufacturing products of the future
- increase the introduction of innovative technologies enabling manufacturing, which will
  - improve the profitability of industrial research,
  - increase market shares and revenues for participating businesses,
  - increase the added-value product segments

  The above will also enhance the firms' capability to invest in longer-term technology-based competitiveness, and by so doing also
- facilitate moves from quality and cost to value-added production
- maximize resource utilisation and reduce negative externalities (emissions and waste) making manufacturing industry more long-term effective and sustainable
- enhance the industry's market responsiveness by combining productivity and flexibility
- capitalize on benefits from improved staff health and safety
- support new approaches to management of supply chains and facilitate transition from *Product/Services Systems (product-centred approach) to Services through Product (solution-oriented approach),* composition of services for product operations, and end-of-life disposal)

According to the *leverage effect of Photonics Technologies* (Butter et al. 2011)[92] report, manufacturing of vehicles airplanes, space infrastructure, road & rail transport equipment, logistics infrastructure, and large machinery will be significantly impacted by photonics industries. As photonics is still growing and developing, it is expected that higher level of industry dependency on photonics sector will increase in the next decade. Especially, laser systems and advanced lighting will become important for manufacturing of vehicles and large machinery. As regards aviation and space infrastructure markets, it will be the technologies of scanning, sensing and imaging, screening and displays that will be most relevant, with photonic energy systems having even larger impacts.

Despite the difficulty to find evidence and establish if and how network programmes affect companies' results, the European Competitiveness report also highlights the advantages produced by network participation against more traditional forms of collaborative arrangements. Networks can provide shared services and connect individual firms from weaker regional clusters, recomb technologies and capabilities from traditionally different clusters and reach out to a larger number of SMEs avoiding high process costs. By so doing they can help companies to collaborate, explore growth opportunities in larger markets and improve the regional scale of competitiveness. Specifically the following types of network programmes have potentials for fostering of economic development and might thus positively impact the European industry's competitiveness

- networks in emerging industries and technology development clusters;
- national cluster platforms that provide shared services and connect firms across regions; and

[92] According to the report a full analysis of the projected industry and market size in 2020 was not conducted

- networks of SMEs active in areas with positive externalities, such as innovation and exports to new markets

A European Policy Center study (Dhéret, Martens and Zuleeg 2012)[93] which used interviews with stakeholders to analyze their perceptions of the role that PPPs may play in the future, as well as literature reviewed suggests that PPPs are usually good solutions for transportation projects. However, it should not be taken as a rule but rather as indication that, in order to succeed, the speed of technological change must also be taken into account, along with the needs for financial transparency, clearly defined value-for-money ratio and well-designed instrument for its inter-temporal monitoring.

7.2.1 Rail

Direct impacts

Railways do not seem to be at the center of industrial and competitiveness policies. Although it has been generally difficult to find impacts on each of the specific transport modes, this has been especially difficult in the case of the rail sector. However, we may extract some conclusions from the literature reviewed.

Specific guidelines on state aid for this sector may facilitate access to finance enabling RU to make the necessary investments to develop infrastructure where appropriate; providing liquidity to rail operators to renew the fleet; and giving the entire rail industry (including the manufacturing companies) the possibility to make the necessary companies' restructurings. Furthermore, permissions to establish certain concerted practices may optimize the use of current existing infrastructure and rationalize rail operations improving the cost-effectiveness of railway services providers. Additionally policies promoting sustainable awareness in the tourism sector might increase passenger flows from other modes of transport to railways while development of industrial applications from other industries may increase cost-effectiveness of both passenger and freight rail services.

Impacts exerted on the rail manufacturing industry in form of increased demand for rail equipment shall increase the income of rail manufacturing companies, and, eventually their revenues, depending on if and how that income exceeds or not investment required to supply with that increased (and possibly new) demand. However, as mentioned in previous chapters, it is arguable how more efficient and/or increased demand for passenger services can enhance the competitiveness of the rail service provision industry from a global perspective, since such services generally do not serve long distances. But when it comes to rail freight transport services the impact on global competitiveness of the rail industry may be large, provided such services develop at greater scale to serve long distance transport of goods between European and South/East Asian markets.

[93] The study bases on interviews with stakeholders to analyses their perceptions of the role that Public Private Partnerships (PPPs) mainly looking into the future.

Research Impacts and Industrial Outcomes

The research within ETPs and JTUs previously described supports the development of rail manufacturing and service industry by identifying research needs to cope with the current and future challenges. For the rail industry EuMAt, EUROP and Photonics may be especially relevant to develop efficient rail transport equipment, increase the use of new materials in manufacturing of such equipment; optimize production and assembling processes and develop autonomous transport alternatives.

Some projects have been summarized in the table at the end of this chapter. Main impacts of those research projects are cost reductions related to several fields such as infrastructure development and maintenance, infrastructure management systems and HS driver assistance, the development of new innovative engineering practices, certification and systems' design; standardization and optimization of design and production; quality and safety improvements; reductions in market deployment times; and provision of platform solutions.

7.2.2 Road

Direct impacts

An instrument, not yet mentioned in the review of policies because it was prior to 2008 was the Risk Sharing Financial Facility. According to the Mid-Term Evaluation Report, this tool has "*contributed to a situation, where the US car producers lost much more ground in comparison to the European car manufacturers"* during the 2009 crisis (Mann et al. 2010).

An OCDE study (OECD 2012) identifies general effects of counterfeiting and piracy on industry which involve stealing of market share from legitimate business, undermining innovation and market distortion. Products' sales and prices are also affected and the brand's reputation may be eroded. Furthermore, costs in which firms incur to counteract such illegal practices arise and royalties are diminished. According to its analysis on automotive sector, spare parts and components (brake pads, clutch plates, oil filters, suspension and steering components and spark plugs) are the items most susceptible to being illegally copied. However, evidence of patent and design infringements for both components and vehicles is also found. Comparatively low penalties, fewer prospects of detection and prosecution, and insufficient IP rights enable the production and distribution of such parts. China is also a major origin country for counterfeits within this sector along with Thailand, Turkey, Russia, the Middle East and Latin America while transit countries frequently mentioned are UAE and Hong Kong. As the effects mentioned above apply to automotive sector, the legal measures protecting trademark rights seem to be inefficient.

The EC report on EU customs enforcement of intellectual property rights (EC 2012 b) informed that in 2011 428.725 vehicles, accessories and parts worth € 27.145.816 were detained at EU borders suspected of violating the intellectual property protection rights. About 61% proceed from China, 25% from United Arab Emirates and 7% from Hong Kong. There was an increase as compared to 2010 (EC 2011 e) where 104.935 articles worth in 6.839.182 € were registered coming from China (45%), Hong Kong (34%) and Libya (4%). Still, share of automotive counterfeits in the domestic retail value of all IPR infringing articles which accounted for €1.2 billion is relative small.

There are further studies which discuss several issues related to the protection of companies' know-how. However, they refer to adopted legislation previous to 2008[94].

The study on the effects of State Aid measures (EC 2011 f) points out that, although the State Aid Framework was open to all sectors, it may have mostly serve as a supportive measure for the automotive sector since it was observed that some MS used it with this scope and the major European auto manufacturers could indeed remain active in the market. It reports that the automotive sector received at least € 9 billion of loans and guarantees granted in favour of only six manufacturers: Ford, Volvo, Saab, Opel, Peugeot, and Renault in 2009/2010, though some of them repaid their loans (as the study points out possibly due to the fact that the level of remuneration required was quite high and constituted an incentive to exit). For instance, notifications to the Commission regarding State guarantees to loans with reduced interest rates and subsidised loans for the production of green products were mostly applied to the car industry (and specially to the car components).

Research impacts and Industrial Outcomes

The automotive industry is the main private investor in research (28 billion per year) and plays a central role in the transition towards more energy efficiency and alternative sources, and advanced technologies and materials for production[95].

Thanks to the research, Intelligent Transport Systems solutions have optimised the road energy consumption and reduced urban congestion by 15%. Additional improvements could increase the latter number up to 25% (Papí et al. 2007). For road users and road operators involved in logistics and freight transport these research-based improvements are quite important as they improve the operational efficiency.

Furthermore, according to the *Mid-term review of the European satellite radio navigation programme* (EC 2011/C5), construction and deployment of the European GNSS are generating benefits and growth possibilities for companies needs for skilled jobs both in the up- and downstream markets. These policies combined with the necessity to reduce congestion, change driving behavior and improve transport safety for dangerous goods have driven the co-funding of several projects (NESSI 2011) which developed new prototypes, demonstrated the systems processes and established bases for new range of applications.

As the road sector is an eager consumer market of GNNS applications (navigation devices)[96], it

[94] For example Hogan Lovells International LLP has elaborated a report for the European Commission on Trade Secrets and Parasitic Copying (Look-alikes), which concludes that EU Directive on the Enforcement of Intellectual Property Rights seem to have improve companies' protection in some but not in all MS.

[95] European Union. Press release CARS2020 from November 8, 2012. http://europa.eu/rapid/press-release_SPEECH-12-792_en.htm

[96] European Commission, Enterprise and Industry, Satellite Navigation, Galileo: Applications for aviation, accessed May 3, 2013 http://ec.europa.eu/enterprise/policies/satnav/galileo/applications/index_en.htm

makes sense to assume that the development of GNNS will also affect the automobile and road freight industry. Further research and efforts in implementing the European GNNS may spread in-car navigation, development of new devices and applications such as toll collection, emergency call, accident reconstruction, anti-theft monitoring or advanced driver assistance systems, all of which are highly relevant for freight and logistics industry. Identification and location of disruptions will enable companies to rapidly re-arrange services, which will increase customer satisfaction, prevent economic losses and reduce threats for environment and people. Some projects along with their scope and relevance for the transport industry are summarized in the table at the end of this chapter.

7.2.3 Waterborne

Direct impacts

According to the report on the impact of effectiveness of EU public procurement legislation (EC 2011/S853), as liberalization of European port sector, defined as establishment of a European maritime space without borders have not yet materialized, competition - although it exists - has not become more intensive as compared to 2004. The ownership still remains mainly public and there is little evidence that the new regulation has actually driven the efficiency up. Still, the SWOT analysis of a further study (ECORYS 2009 b) recognizes existing transport policies with regards to the greening of transport, increased transport industry and enhanced requirements regarding shipping standards as opportunities for the European shipbuilding industry.

Taking into account the high-level heterogeneity and increase number of SMEs within the marine equipment supply (estimates range from 5,000 to 9,000 suppliers worldwide), many of which are also active in other business areas, e.g., car or airplane industry (ECORYS 2009), we shall think that all the impacts related above regarding to small companies are quite relevant for the maritime equipment supply industry.

The mechanisms allowed by the State Aid Framework for the Shipbuilding industry help the sector secure financing during the construction phase of vessels. In fact, on a Communication of 2009 (EC 2009/C8) it was stated that measures, which had been introduced by Member States, in line with the Community Guidelines for State aids for maritime transport, had contributed to keeping part of the fleet on European registers and generating jobs for European seafarers. In the same Communication the Commission recognized, though, that European flags still faced acute competition from the registers of third countries, which were offered significant advantages in terms of government support, access to cheap capital, and abundant labour or flexible enforcement of internationally agreed standards.

IPR protection for this sector seems not to be appropriate since many companies decide not to protect their knowledge due to either enforcement difficulties in foreign markets or high costs as well as burden of proof. Besides, the fact that half of the knowledge leakage occurs in Europe (at yards and equipment suppliers but also through clients and classification societies) supports this statement. However, it seems that no binding legislation has been taken up regarding these issues since the study was done, so no positive effect can be expected. Precisely, in lack of binding legislation or poor enforcement, agreements and dialogues set up with countries such as China or

South Korea help both partners to cooperate on competition issues and discuss matters of mutual interest by exchanging information and coordination of enforcement activities. This may be specially useful with regards to non-compliance of IPR protection in foreign markets (specially in China), for which the study identifies the following barriers: low commitment to respecting and enforcing IP laws, local protectionism, lack of technical training and experience as well as of enforcement tools and independent judiciary, unfavourable procedural requirements to foreign forms and low amount of infringement penalties. It may also help identify international trade barriers preventing globalization of the shipbuilding industry such as subsidies and FDI restrictions.

Research impacts and Industrial Outcomes

Leader SHIP2015 has contributed to improvement of public perception of shipbuilding sector. It is now being considered as a modern and efficient manufacturing industry that provides jobs and drives growth in transport, trade, tourism and other areas. Besides, by developing roadmaps and strategies it has brought stakeholders together and helped them to adapt to discontinuation of operating aid (2000) and new challenges (EC 2007/C220).

European GNSS services have already exerted a positive impact on the waterborne sector through track control, container ship ship-to-ship coordination, port approach and navigation, ship-to-shore coordination, better shore-to-ship management and more efficient calamity abatement. Galileo Search and Rescue (SAR) Service will reduce the time to locate the emergency beacon by the emergency services.[97]

Furthermore, by integrating knowledge and improving or developing new design tools and production techniques the projects funded by the EU 5th, 6th and 7th Research Frameworks have also increased the competitiveness of the European waterborne industry. Besides, reducing the design and production costs, improving manufacturing processes and fuel consumption, increasing operational efficiency, and facilitating business transactions, have contributed to increasing the quality and performance of the vessels and, in general, the productivity of the entire maritime industry. Some results from the main projects are given in the table at the end of this chapter.

7.2.4 Air

Direct impacts

According to the Annex 9 of a report evaluating the impact of effectiveness of EU public procurement legislation (EC 2011/S853), as liberalization and competition intensification in ground handling services and airlines has increased, so did the pressure on airports to perform more efficiently. This was further driven by higher degree of privatization and sector-specific legislation related to services offered at airports but not by airports themselves.

Some documents were found reporting on global alliances. For instance a study (EC and U.S. Department of Transportation 2010) mentioned some potential benefits from consolidation or

[97] European Commission, Enterprise and Industry, Satellite Navigation, Galileo: Applications for maritime transport, accessed April 4, 2013. http://ec.europa.eu/enterprise/policies/satnav/galileo/applications/maritime-transport/index_en.htm

cooperation between airlines. Among them:

- Lower-per-passenger costs due to economies of density (which produce cost savings by carrying the new acquired passenger volume over main routes)
- The former may drive airlines to increase capacity
- Lower fares due to the elimination of double marginalization (though this depends on number of competitors in a market and customers' price sensitivity)
- More seamless and better schedules, frequent flyer benefits
- Increase customer satisfaction

However, these are benefits which are not limited to the European carriers since global alliances involve foreign carriers (being the central partners North American and European carriers).

Another report (Brueckner, Lee and Singer 2010) concludes with the fact that full airline cooperation lead to fare reductions, something which according to the study "largely confirm previous results", though it admits some minor differences in that price gap between online and fully cooperative alliance service that widens significantly for business-class passengers. Furthermore, the document reports that the difference between online and traditional interline fares has declined worldwide, and that there is a modest decline in the importance of antitrust immunity relative to other forms of airline cooperation.

Last, another document[98] reviews the EC's competitive assessment with regards to the cooperation and consolidation of British Airways, Iberia and American Airlines. With regards to the antitrust case the Commission found that there were concerns for restriction of competition between parties and between parties and third parties as well as anti-competitive effects on six hub-to-hub routes. The reasons for the assessment (which only involved long-haul services) were that

- parties were the closest competitors in terms of frequencies, schedules and service quality,
- parties' position was protected by high barriers to entry, in particular the lack of slots but also high number of frequencies, extensive FFPs and hub advantage
- the agreements would be likely to lead to an increase in fares (as showed by regression analysis of price concentration conducted by the Commission)

Against these assessments airlines made some commitments, which the Commission would not oppose. These

- Make slots available to competitors (provided these do not have already unused slots) within reduced time window and restricted to certain hours.
- Conclude fare combinability agreements with competitors on the routes of concern
- Enter into special prorate agreements (SPAs) with competitors on those routes to enable competitors to attract passenger flows from the airlines involved in the assessment.

With regards to the Iberia/British Airways merger case which related on two short-haul routes (London-Madrid and London-Barcelona) the Commission concluded that the merger does not give rise to competition concerns on any of these routes.

[98] EC. 2010. Competition Policy Newsletter Number 3/2010. accessed May 31, 2013 at http://ec.europa.eu/competition/publications/cpn/

Regarding non- aviation taxes a US study for the years 2000-2005 reports that, Boeing attributes a portion of its declining share of the European market (down 50 percent to 13 percent) to the differences in U.S. and European tax regimes (U.S. Department of Commerce, International Trade Administration 2005) regarding international aerospace products' sales.

Research impacts and industrial outcomes

The *Metrics and success criteria for ARTEMIS* (ARTEMIS 2011) already mentioned above explicitly mentioned reduction of cost and time-to-market by means of *creating tools for interoperability standard capability to conduct trade-offs, collaborative work based on multi-views modeling and dependability improvement of components as possible outcomes*, enhancing market conditions for aeronautics. Positive impacts are also expected from the development of unmanned flying systems.

A positive effect of EGNOS is that it does not require installation of expensive land based navigation aids necessary for Instrument Landing System (ILS) because it enables en-route navigation and allows for IFR-like (Instrument flight rules) operations at non-ILS equipped airports[99].

Generally, according to the MEFISTO Report (MEFISTO 2010), the 5th and 6th Framework Programmes helped to increase competitiveness of aeronautic sector, support initiatives to confront environmental problems and develop innovative aircraft structures, integrate research capacities of the sector and increase business' cooperation. Research work had directly contributed to increased competitiveness by developing advanced technologies, something which had not been possible without the European funding. More specifically turbofans and counter rotating open rotor engines have been developed thanks to improved manufacturing techniques, new materials and new engine configurations. Other projects have already demonstrated that reducing and delaying the effects of the shock waves (increased drag) through active flow control is possible. However, the report also recognized the need to facilitate the technology demonstration to incorporate these developments into real market products. In this sense, demonstrations and further investigation within the Clean Sky project (FP 7) are to be continued.

When it comes to industrial outcomes, according to the same report (MEFISTO 2010) and results from the VIVACE project, the latter led by Airbus, several multidisciplinary design teams are currently used to optimize the design process of an aircraft by using modeling and simulation, and thereby saving time and costs during integration of sub-assemblies delivered by several aircraft suppliers. Furthermore, results from other projects (TANGO and ALCAS) convinced Airbus to design A-350 fuselage using composite materials, which previously had only been used for secondary structures. This (as we reviewed in the chapter on environmental policy) will make aircrafts lighter and reduce fuel consumption and emissions.

[99] European Commission, Enterprise and Industry, Satellite Navigation, Galileo: Applications for aviation, accessed April 04th, 2013 http://ec.europa.eu/enterprise/policies/satnav/galileo/applications/aviation/index_en.htm

However, there are also some negativities with regards to European R&D landscape (ECORYS 2009 a). Among them we find that European schemes are regarded as too bureaucratic, there is duplication of research activities across MS but also within them, and views on that EU created platforms such as ERA-NET (European Research Activities-Network) are being underutilized by the industry. Furthermore, there are also critics towards the creation of PPPs (especially the CleanSky initiative), which is not delivering according to the projects' size, lacks the necessary authority for decision making and does not sufficiently integrate the industry in governing projects.

7.3 Assessment of impacts

Assessing the effects and impacts of industrial competitiveness policy may be even more complex because it is a collection of different policies. The last chapters have tried to give an overview of the objectives that recent past policies regarding competition, industry, research and innovation, finance, external trade, internal market and public procurement have pursued, as well as of their effects with regards the competitiveness of the transport industry according to the studies reviewed.

A big challenge is balancing the multiple goals of this compilation of policies which cover different areas. Public policies and public support aimed at protecting and enhancing the European economy, improving the efficiency of industries and increasing their performance must not endanger efforts to protect European citizens and consumers and achieve a sustainable mobility. Moreover, they need to address industrial competitiveness both at intra and extra EU level without harming competition. State aid, mergers and antitrust control play a significant role in balancing precisely this matter, since they level out industry's interest and societal needs. With this scope, policies covering specific sectors (SGEI, railways, shipbuilding, etc.), global economic contexts (crisis) and/or activities contributing to enhance services and manufacturing industries (rationalization of transport, tariff structure uniformity, joint scheduling, timetable and routes coordination, development of data exchange systems, etc.) are issued by the European institutions.

From promoting broad multidisciplinary research through the creation of several JTI by regulations, European policies are increasingly turning innovation into an overarching objective of any policy measure to increase the potential of getting industrial outcomes out of research development efforts. In this sense facilitating the investment capacity of firms and helping them to overcome the economic downturn without giving up innovation, mechanisms such as the RSFF and more recently, the bond initiative have been introduced. A further tool being promoted to boost innovation has been public procurement. To exploit its potential, changes have been proposed that seek simplifying the rules and requirements as well as facilitating cross-border procurement and use of electronic channels.

But as not everything depends on Europe's industry own capacity to innovate and markets are becoming increasingly global, policies targeting areas beyond European borders are necessary. Legislation has been adopted whenever possible, for instance to protect European products from imports which are either dumped or strongly subsidized. But when dealing with global challenges many agreements are only possible to achieve through voluntary cooperation. Besides, the necessity of involving different goals and policy areas as well as different needs of MS and industries'

specific characteristics require a good deal of informality.

To informal policies belong global trade agreements, FTA negotiations and dialogues with neighbouring and / or emerging countries to expand markets or policies to promote the voluntary adoption of CSR principles. Cooperation within ETPs and JTIs is also mainly on a voluntary basis, though the creation of the later was supported by binding legislation. Initiatives helping European SMEs to internationalize (business centers, programmes, networks and online portals) or the creation of the Observatory on Counterfeiting and Piracy to complement the existing legislation, improve the quality of data, raise awareness and promote cooperation and the establishment of voluntary agreements are also examples of European soft policies.
The complexity of these policies and the lack of studies assessing if and if so how far policy objectives have been achieved difficult the process of assessing the impact that such policies had on the competitiveness of the European transport industry, especially because neither industries across Europe nor MS departing political, economical and societal framework conditions are uniform. But also because in the current evolving economic, social and political context, measures are reviewed, enhanced and/or discharged, not leaving enough time to assess which impacts are due to what legislation.

For instance it has been asserted that inward FDI, a major goal within the EU industrial policy (EC 2010/C614) has positive effects on European firms but specific studies for the transport industry could not be found and even when considering the complete European industry the effects greatly vary depending on multiple issues which are influenced by other policy areas such as education, transport infrastructure, taxation or employment, which are also quite different from country to country. Moreover, FDI inflows may increase labour productivity and the ability to innovate but this depends on the company size and technology and productivity levels of firms. Similarly outward FDI does not automatically translate into increased competitiveness. The relative trade balance and revealed comparative advantage (RCA) of transport related industries strongly vary across MS. As a whole, and despite the fact that EU reveals RCA for technology and knowledge intensive industries, RCA of the European “other transport equipment” industry does not keep up with that of Brazil, neither do it with Russia’s RCA of the “transport service” industry, and Japan’s RCA beats Europe’s in both industries as well as in the “motor vehicles, trailers and semitrailers” industry. Besides, relative trade balance of European “motor vehicles, trailers and semitrailers” and of “other transport equipment” industries lay behind India’s, and China’s, respectively, as well as that of Japan’s for both industries.

FDI can be seen as a way to internationalize. Other support measures have helped SMEs go global by means of helping them knowing better the new markets and their demand needs, developing license and franchising agreements and supporting export activities, all of which have increase their capacity to assess new business opportunities and develop them. Nevertheless, despite these positive effects SMEs still find barriers to expand business abroad, among which we find lack of capital, language skills, legal and cultural barriers but also paper work burden and insufficient information, partly because they experience public support as insufficient and/or are unaware of the full spectrum of the supportive measures. However, how far these effects also apply exclusively for transport related companies is unclear since none of the studies found and reviewed targeted

specifically this sector.

We have also studied two of the policies to be considered quite burdensome by SMEs: public procurement and IPR. Regarding public procurement differences are also great between countries but generally outcomes have not quite evolved as expected with regards to the share of cross border activity. The past legislation on public procurement has shown to more transparent although the competition levels but in rail, ports and airports has not achieved the level expected as yet. The progressive inclusion of environmental and social concerns into public procurement practices might have both negative (increased administrative burden) and positive effects (efficiency gains from improved knowledge on their business activities and sustainable awareness) on companies in general, and there is no reason to think why those effects should not be applicable for companies active in the transport sector. At any case rapid and inconsistent changes would increase the risk of negativities so currently new legislation is being designed considering a wide range of measures possibilities. While the outcomes of some of the proposed measures are not certain, other measures (electronic communication tools, removal of administrative barriers, identification of national authorities in charge of implementation, control, monitoring and reporting of public procurement) seem to be capable of delivering benefits with more certainty.

With regards to IPR, legislation seem to be insufficient in protecting companies interests as reported for the automotive and the shipbuilding sector, though in the later this is also due not only to the inefficiency of the legislative measures but also to the unwillingness of the companies to protect their knowledge because of enforcement difficulties in foreign markets and high costs related to burden proof. One possible consequence is that European companies lose market share but this might also discourage companies from innovating, which may have stronger consequences on a long termed basis.

State aid, mergers and antitrust control policy's impacts are, like the previous ones, difficult to isolate since they all interact with different policies and contexts. Nevertheless evidence reveals that such measures have supported corporate investment and facilitate access to finance as credit standards have been eased. They have been especially useful to keep the European automotive sector active in global markets and increasing their capacity to continue developing products for evolving needs, as well as to avoid the escape of European flags in the waterborne sector. Still there are concerns about the long term sustainability of these measures. Other financial supportive measures (RSFF) have also proved helpful in supporting the European automotive industry against overseas' competitors. Several positive effects derived from the consolidation of global airlines' alliances have been mentioned (lower per passenger costs and fares, increased customer satisfaction, increased capacity, etc.), but these do not exclusively affect European carriers. Delimiting the effects of such practices to a regional area in globalized industries will be increasingly complex.

The review of research supporting measures including public funding and the promotion of networks (ETPs and JTIs) shows that mostly it can be talked more about expected than past industrial outcomes. Nevertheless, their relevance is key in supporting regulatory policies because both public funding and support of networks promote innovation and also increase investment

capacity by means of reducing costs and improving manufacturing processes and operational efficiency but also by providing companies and industries with a certain degree of certainty, integrating knowledge and coordinating efforts. Besides, first important steps have been taken – the identification of key technologies and facilitators (KETs and GNSS) as well as possible applications (toll collection devices, anti-theft monitoring, driver assistance systems, tracking systems, emergency response services) and first objectives and solutions (development of prototypes; design and development of products and new applications, management or decision support system; concept validation; realization of demonstrations; and successful application of new materials) have been achieved. These achievements have contributed to quality and capacity improvements; delays and costs reductions, efficiency and cost effectiveness increases, resource use and processes' optimization, industrial uptake, increased flexibility and user satisfaction, and energy savings. They have also facilitated certification and standardization, reduce the risk of fatalities and widen the field of solutions' applicability. In this sense, although framework programs have been especially intensive on the aviation sector as well as in "radical technologies", the spillovers to other sectors must also be considered. A more detailed overview of the projects contribution to the competitiveness of the European transport industry is given in table 13. Despite the achievements made it is pointed out that efforts to support research and networks across modes must be intensified. Moreover, industrialization of products and the deployment of new solutions as well as users training need to be targeted.

The relevance of transport is highlighted in some policy documents. A well developed transport infrastructure is key for the European industry as a whole and not less for efficient transport services and the proper functioning of the distribution and supply chain of the transport manufacturing industry. And the manufacturing of clean vehicles and vessels and energy efficient transport equipment are industries where the deployment of KET and innovation make produce great benefits which may also have spillovers to other industries.

7.4 Summary of impacts

The following tables summarize the direct impacts of binding legislation as well as the outcomes of some projects explored

Table 13: Summary of direct impacts of legislation

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the European transport industry's competitiveness
Air	Competition Policy: Antitrust legislation	Regulation (EC) No 487/2009	enable block exemptions for certain agreements, decisions and concerted practices in the air transport sector concerning certain activities such as joint planning and coordination of airline schedules, consultations on tariffs, joint operations on new less busy scheduled air services, slot allocation at airports and airport scheduling and purchase, development and operation of CRS	Lower-per-passenger costs, increased capacity, lower fares, seamless and better schedules, frequent flyer benefits. This will lead to an increased customer satisfaction and efficiency. Better information of services for customers may increase the pressure on carriers to offer more competitive services. On the other side, there competition restrictions are possible. *Since alliances are global, impacts won't be limited to European carriers.*
Water borne	Competition Policy: Antitrust legislation	Regulation (EC) No 906/2009	enable certain agreements and cooperation such as the joint operation of a maritime transport service and the improvement of the service that each member would offer individually in order for international liner shipping companies to rationalise their operations	Impacts are unclear since no study was found but if the objectives pursued are achieved could result in operational gains for companies and improved services which may improve the perception of maritime service, attracting customers.
Road, Rail and Inland Waterways	Competition Policy: Antitrust legislation	Regulation (EC) No 169/2009	exempt agreements, decisions and concerted practices between firms in the rail, road and inland waterway transport sectors from the general prohibition (Art. 101 and 102 of the TFEU) against anticompetitive agreements, concerted practices and abuses of dominance, as long as they have the object and effect of applying technical improvements or achieving technical cooperation by established means	Impacts are unclear since no study was found but if properly enforced this legislation may promote innovative transport solutions through the sharing and integration of technological knowledge and cooperation without putting at risk a competitive environment that thrives individual developments.
Rail	Competition Policy: State Aid	Communication (2008/C 184/07)	provide guidance on the compatibility of State aid for railway undertakings with the Treaty (prohibition of market distortion) and improve the transparency of public financing and legal certainty with this regard in the context of the opening-up of the markets	Impacts are unclear since no study was found but increased transparency and guidance may facilitate the administrative burdens for companies and release resources for other fields. Financial support can enhance investment possibilities of RU.
Water borne	Competition Policy: State Aid	Communication 2011/C 364/06	continue to apply specific provisions until 31/12/2013 for the shipbuilding sector in respect of a) innovation aid providing MS with the identification of specific requirements to ensure the presence of an incentive effect; and b) regional aid	This framework is believed to have contributed to keeping fleets on European registers avoiding employment destruction.
Water borne	Competition Policy: State Aid	Communication 2009/C 132/06	authorise tax relief for outsourcing of ship management companies with respect to in-house ship management, provided that they meet the same requirements as are applicable to ship owners and that the provision of the aid to the former contributes to the	Impacts are unclear since no study was found but tax relief may be a useful tool to allow European ship management companies keeping prices more competitive in the global market.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the European transport industry's competitiveness
			achievement of the objectives of the Guidelines in the same way as the provision of aid to shipowners	
Water borne	Competition Policy: State Aid	Communication (2008/C 317/08)	authorise State aid to the start-up of Marco Polo II 'Motorways of the Sea' projects with a maximum intensity of 35 % of operational costs and a maximum duration of five years in order to grant for complementary State Aid beyond of what is allowed for short sea shipping (SSS)	Impacts are unclear since no study was found but its objective, which is enhancing financial support of SSS, may be helpful to reduce costs of SSS and facilitate funds to invest in improved services, thus, attracting users from other transport modes. Unclear how this may affect road hauliers and/or railways.
All	Competition Policy: State Aid	Communications (2009/C 16/01) (2011/C 6/05)	(2009) unblock bank lending to companies and guarantee continuity in their access to finance and encourage them to continue investing in the future, in particular in a sustainable growth economy (2011) limit the prolongation of certain measures and introduce stricter conditions on the prolonged measures so as to gradually return to normal State aid rules, while limiting their impact on competition	Supporting corporate investment and easing access to finance has helped companies in the automotive sector to remain in the market and has promoted the production of green products. It is unclear how cutting off such measures will impact on the industry, even if this happens at a progressive slow pace.
All	Competition Policy: State Aid	Regulation (EU) No 360/2012	complement the general State aid "de minimis" rule and provide for a higher ceiling (500.000 over any period of three fiscal years instead of previous 200.000) for undertakings providing SGEI under which such aid does not need to be notified - provided also that the conditions on accumulation are respected	This measure has acted as a working capital support, especially for SMEs.
All	Competition Policy: State Aid	Communication COM(2011) 146	launch the political debate with stakeholders and other institutions on the revision of the State Aid Package to increase the contribution that SGEI to the EU economic recovery and guarantee certain services at affordable conditions to citizens, and present the principles considered according to inputs provided by a public consultation. It should be noted that *"in sectors characterised by large scale commercial activity with a clear EU wide dimension* (transport) *where operators may be entrusted with public service obligations, … sectoral rules apply instead of the general SGEI Decision and SGEI Framework*" (EC 2011/C146)	Impacts are unclear since no study was found on making compliance easier and more effective. Greater attention may be put on efficiency and quality when deciding which SGEI activities are eligible for state aid. This may withdraw or sharpen state aid conditions and thrive those activities into a higher degree of competition, perhaps making them more efficient which can contribute to improve the environment of any industry, also the transport industry, by improving the conditions regarding for instance energy supply and education. Past policies (2005) increased the legal certainty of state aid measures.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the European transport industry's competitiveness
All	Competition Policy: State Aid	Regulation (EC) No 800/2008	simplify and consolidate the EU regulations for exempted aid, widen the field of application of the exemptions, improve transparency of aid measures and strengthen the efficiency of inspections	Impacts are unclear since no study was found but procedures may be improved releasing financial and time resources for other issues and ensuring the proper allocation of public money and its created value.
Road	Competition Policy: Vertical Agreements	Regulation (EU) No 461/2010	draw a distinction between vertical agreements for the distribution of new motor vehicles and agreements for the provision of repair and maintenance services and distribution of spare parts: a) block exemption for vertical agreements for the purchase, sale or resale of new motor vehicles as by Reg. 1400/2002 defined is extended 31 May 2013, from where Reg. 330/2010 applies; and b) vertical agreements concerning conditions for the purchase, sale or resale of spare parts for motor vehicles, or for the provision of repair and maintenance services for motor vehicles are allowed as long as these fulfil the requirements for exemption under Reg. No 330/2010	Impacts are unclear since no study was found but the objectives pursued (minimize distribution costs, increase production efficiency and optimize investments) may favour the efficiency of business activities enabling them to deliver better products and services, presumably without distorting competition
Road	Competition Policy: Vertical Agreements	Regulation (EU) No 330/2010	enable certain vertical agreements by block exemption making the prohibition of Article 101(1) TFEU inapplicable as long as they fulfill certain requirements	
All	Corporate Social Responsibility Strategy	Communication COM(2011) 681	give a new definition of how CSR should be understood and propose a new agenda for action	There is no evidence of impacts on the transport manufacturing and service industry. The benefits of implementation of CSR in business strategies include gains from resource efficiency, better reputation (i.e. by reducing environmental footprint and or improving social conditions of workers and communities) and better knowledge of market environment and customer needs' through active dialogue with stakeholders.
All	Economic and Financial Affairs: EU Project bonds initiative	Regulation (EU) No 670/2012	establish the pilot phase of the EU-EIB Project Bond Initiative which shall revive and expand capital markets to finance large European infrastructure projects in the fields of transport, energy and information technology	It is still too soon to be assessed but improving financial access to develop transport infrastructure may improve transport services and open the market for new transport solutions which may require new or developed equipment from manufacturing suppliers
All	External Relations: External Trade	Regulation (EC) No 1225/2009	set out the rules (regarding calculation of dumping, procedures for initiating and pursuing an investigation, the imposition of provisional and definitive measures and the duration and review of anti-dumping measures) in order to protect the EU industry against	Impacts are unclear since no study was found but since the objective is to protect European firms from practices such as dumped products and subsidies without compromising the freedom of import, these legislative measures may favour the grounds for a fair competition between European and non European products.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the European transport industry's competitiveness
			dumped product whose release for free circulation in the Community causes injury on producers of the same or similar products	
All	External Relations: External Trade	Regulation (EC) No 260/2009	establish common rules for imports into the European Union (EU) based on the principle of the freedom of import and to define the procedures enabling the EU to implement, where necessary, the surveillance and safeguard measures required to protect its interests	
All	External Relations: External Trade	Regulation (EC) No 625/2009		
All	External Relations: External Trade	Regulation (EC) No 597/2009	counteract subsidies that are deemed to cause injury to the EU industry	
All	Industrial policy	Communication COM(2010) 614	facilitate a strategy for the dynamic growth path strengthening EU competitiveness, providing growth and jobs, and enabling the transition to a low-carbon and resource-efficient economy	Impacts are unclear since no study was found but competitiveness of the industry may be enhanced by the strategies identified in these policy documents, namely – Business internationalization supporting measures – Financial access facilitation – KET development – Support of business creation and growth By recognizing in the transport sector a key area to support the development of the entire European industry and seeing in clean vehicles and vessels manufacturing industries, business in which investment to support technological development may pay out, the strategies may broaden the sectors' possibilities.
All	Industrial Policy	Communication COM(2009) 512	Formulation of KETs, identifying barriers and describing actions for their development	
All	Industrial Policy: Entrepreneurship	Communication COM(2012) 582	update and support the "Integrated Industrial Policy for the Globalisation Era" adopted by the Commission in 2010 in moving towards the Europe 2020 objectives d	
All	Industrial Policy: Entrepreneurship	Communication COM(2012) 795	ease the creation of new businesses and to create a much more supportive environment for existing entrepreneurs, helping European sectorial policies to achieve their goals and contributing to the EU2020 strategy	
All	Industrial Policy: SMEs	Communication COM(2011) 702	create conditions to make SMEs equally engaged in markets outside the EU by means of reviewing the existing support structures available to SME to identify main problem areas and propose a set of measures where European-level action can add most value, and set out guiding principles for the most coherent and efficient use of scarce financial resources in priority markets such as China, Brazil, India, Russia, the US or Japan	To some extent the strategy increases international activities of European business, including exports, thanks to increased knowledge on how to enter markets, and also on demand for improved assessment of market opportunities.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, comm., white papers …	Objectives targeted by the policy	Impact on the European transport industry's competitiveness
Road	Internal Market Policy: Motor vehicles	Communication COM(2009) 104	Describe the causes for the problems within the automotive sector and describe the policy framework to cope with such problems	A better dialogue framework within the CARS21 initiative may facilitate the adoption of a coherent policy from both different policy perspectives and different national industry needs. Support for research investment, partnerships, administration simplification of R&D programs and PPP, and technical standardization may also support the automotive industry.
All	Internal Market Policy: Community Trade mark	Regulation (EC) No 207/2009	establish rules and conditions to be complied with for the granting of Community trademarks and offer uniform protection throughout the territory	At least for the automotive and the shipbuilding sector, legislation seems to be insufficient leading to negative effects. For the former (automotive) infringements (though low compared to other industries) lead to market share stealing, market distortion and undermining innovation. For the later (shipbuilding) high costs related to protecting intellectual property and lack of enforcement in foreign markets make adoption of IPR non worth.
All	Internal Market Policy: Intelectual Property Rights	Communication COM(2009) 467	safeguard intellectual property rights (IPR) and fight against counterfeiting and piracy within the internal market by complementing the existing regulatory framework with non-legislative measures	
All	Internal market: Public procurement	Proposal COM(2011) 895	simplify the rules and adapt them to the evolving political, social and economic context with the scope of increasing the efficiency of public spending (ensuring the best possible outcomes in terms of value for money) and facilitating the participation of SME and the creation of cross-border partnerships. All in support of common societal goals.	Too early to assess since this is only a proposal. Apart from the expected outcomes (increase opportunities for SMEs and international cooperation), implementation of previous public procurement directives have increase openness and transparency which has led to a higher competition level
All	Internal market: Public procurement	Regulation (EU) 1251/2011	increase the contracts' value (excl. VAT) thresholds	Impacts are unclear since no study was found
All	Research and Innovation Policy: European Satellite Navigation Systems	Regulation (EC) No 683/2008	provides rules for the further implementation of EGNOS and GALILEO programmes. The former shall monitors and improves the quality of signals from existing global navigation satellite systems (GNSS) and involves infrastructure management, maintenance, improvement and renewal of the system, marketing, and the certification and standardisation operations whereas the Galileo programme shall establish an independent GNSS infrastructure.	Development of satellite systems may enhance the operational efficiency of transport services, develop new applications and make possible new transport solutions, also intermodal. This all may also affect the manufacturing industry as equipment will presumably need to be adapted.
All	Space industrial Policy: Strategy	Communication COM(2013) 108	give recommendations to develop a EU space industrial policy in accordance with the European 2020 strategy	
All	Research and Innovation Policy: Vision	Communication COM (2010) 546	promote a new approach in policy making, giving innovation an overarching importance	Impacts are unclear since no study was found but giving emphasizing the importance to innovation may help the industry to close the gap with competitors whose innovation investment is more intense.

Table 14: Summary of outcomes of research activities

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Air	Automated Repair and Overhaul System for Aero Turbine Engine Components (AROSATEC)	Development of a new data management system and integration of individual steps into a automated repair chain for maintenance, repair and overhaul (MRO) of aero engine components	Quality improvements
Air	Crosswind-Reduced Separation for Departure Operations (CREDOS)	Development of a Concept of Operations baseline and consolidation of a Validation Case related to tackle adverse wake vortex effects	Airport capacity improvement and reduction of delays at airport
Air	Supporting Platform for Airport Decision-Making and Efficiency Analysis (SPADE)	Design, implementation, testing and evaluation of a user friendly decision-support system for airport stakeholders and policy makers	Enabling trade-off analysis for measures aimed at increasing airport efficiency (capacity delay, level of service, safety, security, environmental impacts and cost-efficiency)
Air	Inflight Lightning Strike Damage Assessment System (ILDAS)	Improving knowledge about in-flight measurement of the properties of lightning strikes	Improve the efficiency of maintenance operations and reducing its cost, reduce aircraft delays and operating cost
Air	Optimised Procedures and Technologies for Improvement of Approach and Landing (OPTIMAL)	Validation of concepts aimed at reducing noise, fuel consumption and emissions, increasing airport capacity as well as safety and cost-effectiveness.	Benefits regarding capacity increase and cost-efectiveness improvement as well as serve as a contribution in further projects (SESAR JU) and implementation of the ATM system
Air	Aeronautics ERA-Net AirTN-Air Transport Net	Networking of European aeronautics stakeholder groups (ACARE, GARTEUR) along with universities, research institutes, manufactures and airports to cooperate and coordinate research activities.	Development of strong links with aeronautics industries and government agencies in third countries, which provides a good opportunity to secure links with foreign markets. Strengthening of the links across Europe, avoiding duplication of effort, and increasing the competitiveness of the industry
Air	GIANT-2 EGNOS Adoption in the Aviation Sector	Acceleration of EGNOS' adoption in regional airlines, corporate and general aviation and helicopters, identifying testing and operational practices for its successful adoption; knowledge building and dissemination to a Europe-wide network of aviation community members with a strong interest in GNSS technology and the potential services; carrying out EGNOS end-to-end LPV applications by performing flight trials that make the use of GNSS the primary positioning technology	Reducing operating costs (derived from delays, onboard equipment, ground NAVAIDs infrastructure and operational efficiency), optimised use of all resources, improved punctuality (on time performance) and reduced delays and greater flexibility in the planning and management of flights
Air	HEDGE Helicopters Deploy GNSS in Europe	Development of the new 'SOAP' approach procedures for offshore helicopter operations, implementing the new ICAO 'PINS' and LPV approach procedures for mountain rescue and Helicopter Emergency Services (HEMS), and demonstrating a new integrated airport surveillance/navigation concept based on EGNOS for positioning. It will also support the certification process for helicopters by data collection and the deployment of EGNOS by developing operational utilities, such as training materials and certification guidance.	Deliverance and demonstration of the innovative applications enabled through EGNOS, bring benefits in safety navigation and surveillance

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Air	ACCEPTA ACCelerating EGNOS adoPTion in Aviation	Providing a full-scale real-life operational context for the adoption and use of the EGNOS signal as a key positioning and navigation sensor, researching the 'business' aspects of application of EGNOS-based LPV procedures, and verifying the validity of the EGNOS signal in space and assure operational execution	Operating costs reduction (associated with CA in terms of missed approaches, diversion of flights to alternate airports, expensive onboard avionics equipment, ground NAVAIDS infrastructure), enhanced efficiency of aircraft operator operations (specifically flight), operational costs reduction (especially during the approach phase), optimised use of all resources for all partners, improved punctuality (on time performance) and delays reduction, and providing greater flexibility in the planning and management of the flights.
Air	CLOSE SEARCH Accurate and safe EGNOS-SoL navigation for UAV-based low-cost SAR operations	Hardware and software prototype that integrates in a small unmanned aircraft (helicopter) a thermal imaging sensor and a multi-sensor BA/RINS/GPS-EGNOS-based navigation system with an Autonomous Integrity Monitoring (AIM) capability to support the search component of search-and-rescue (SAR) operations in remote, difficult-to-access areas and/or in time-critical situations	Use of EGNOS services for mass market: Innovative applications targeted to SMEs and opportunities for transversal applications as well as economic and social benefits
Rail	GRAIL-2 GNSS-based Enhanced Odometry for Rail	Development, testing, validation of a GNSS-based EO system prototype in a real environment to support the odometry with accurate position and speed, and the development of the GRAIL-2 User Terminal and its interface to the onboard ETCS equipment via PROFIBUS and of the ETCS OBU adapting it to the new functions	Use of EGNOS for Safety of Life applications
Rail	CHESS	Improving Model Driven Engineering practices and technologies to better address safety, reliability, performance, robustness and other extra-functional concerns while guaranteeing correctness of component development and composition for embedded systems	Reduction of the development costs through extensive use of provable automation and model transformation engines specifically for high-integrity applications
Road	SISTER (ISI)	no published results found though the project was supposed to end in 2010	Promoting the integration of satellite and terrestrial communications with GALILEO to enable mass market take-up by road transport applications
Road	GINA GNSS for INnovative road Applications	Proving the technical feasibility and economical viability of a large scale GNSS-only road pricing scheme, identifying the potential benefits related to congestion and pollution management, demonstrating the possibility of VAS running on a road pricing operating platform, as well as the use of the same on board equipment shared by different applications, and understanding the added value of the EU technology in terms of performance or cost improvement compared to GPS-only	Innovative GNSS-based Road Applications
Road	GSC GNSS enabled Services Convergence	Demonstrating the benefits of EGNOS (accuracy, availability, integrity and service guarantee) for a GNSS road-pricing solution and GNSS-based road applications, proposing an exploitation and business plan from a commercial perspective, and assessing the effect of road-user charging in reducing congestion	Innovative GNSS-based Road Applications (Road) enabling an open and competitive mass market for different services providers out of the opportunity of developing Intelligent Transport Systems and Services (ITS)

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Road	GALAPAGOS GALileo-based seamless and robust Positioning Applications for Logistics Optimisation Processes	Demonstration of a positioning system designed for logistics applications – specifically for container tracking – based on high sensitivity satellite navigation receivers augmented by EGNOS. It includes development of three modules (positioning systems, communication methods, hardware, software)-application with a clear market implementation focus	Ensuring a continuous and reliable positioning of containers even in complex environments and provide managers with the necessary information to optimise logistics processes. It will also help to reduce resource consumption, air pollution and CO2 emissions Mass-Market GNSS Applications
Road	GSW Galileo Speed Warning	Design and development of a new product: GSW CARAT (Continuous Assessment of Road Attitude) COUNTER, analysis of possibilities to trade or used rewards and incentives and on its influence on a driver's long-term adoption of ISA	Mass-Market GNSS Applications. Relevance goes beyond the transport industry to insurance companies, local authorities and large organisations
Road	SIGNATURE Simple GNSS Assisted and Trusted Receiver	Creation of a SIGNATURE prototype solution which promotes the use of EDAS (EGNOS Data Access Service) to lead to improvements in charging accuracy (right cost per trip), integrity (probability and amount of overcharging) and availability (amount of charged usage)	Mass-Market GNSS Applications (SME)
Road	SCUTUM SeCUring the EU GNSS adopTion in the dangeroUs Material transport	Large-scale adoption of EGNOS use in the transport management of hazardous goods by implementing and extending best-practices, developing products and services ready for the commercial market, validating business feasability and the launch of a technical standardization and an institutional validation	Fleet management and logistics applications
Road	COVEL Cooperative Vehicle Localization for Safe and Sustainable Mobility	Development of a Lane Navigation Assistant (LNA) – an in-vehicle system thatwill enable lane-level positioning, lane-level navigation and lane-level traffic management, especially in urban areas	Use of EGNOS services for mass market: road telematics. Further the transport industry can also benefit from improvments in the positioning accuracy and signal availability in urban areas and an integrated navigation system architecture, lane-level navigation potential and real-time traffic information
Road	GNSSmeter GNSS-based metering for vehicle applications and value added road services	Development of a road-pricing and pay-per-use insurance application system based on a vehicle onboard technology by means of increasing the ability for metering calculations, especially in urban canyons and introducing innovative miniaturised GPS/EGNOS/ Galileo chipset, and creating accident avoidance applications by means of developing a GNSS receiver with PVT (position, velocity, time) and patent-protected software integrating GPS, EGNOS and EDA	Innovative applications targeted to SMEs
Road	ERSEC Enhanced Road Safety by integrating Egnos-Galileo data with on-board Control system	Producing the ERSEC measuring system to be used on board of vehicles which is able to output the position on the road map of the equipped vehicle and of all the obstacles to enhance performance and level of confidence of collision avoidance systems, and expanding the active control system to new functions such as reduction of vehicle speed in proximity of a curve and protection against out-of-road	Innovative applications targeted to SMEs which open the possibility of application of the Automated Guided Vehicles (AGV) also in constrained areas (industrial sites, airports, touristic or hospital centres), where nowadays the required infrastructures to implement the automatic vehicles guidance (rails, buried wires, magnetic beacons) are limiting the system functionality and flexibility and thus its development.

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Road	GENEVA Galileo / EGNOS Enhanced Driver Assistance	Development of an innovative application within advanced driver assistance for high precision, reliable and certifiable use contributing to the adoption of EGNOS/EDAS and the introduction of Galileo in the European automotive industry and reduction of the number of urban road accidents, traffic jams, resource consumption, air pollution and CO2emissions.	Use of EGNOS services for mass market: road telematics
Road	PUMA Precise and secUre autoMative trAcking	Development and commercialization of a on board unit (OBU) prototype with anti-spoofing capabilities, which in normal circumstances will work as a standard tracking unit but under a jamming or spoofing attack would be able to reconstruct the real path of the vehicle and notify the control centre of the event.	Use of EGNOS services for mass market: Innovative applications targeted to SMEs
Road	E3Car Energy Efficient Electric Car	Improved efficiency of the electrical vehicle using advanced semiconductor components in the areas of Power Conversion, Power Management, Power Distribution Network and Smart Dynamic Monitoring	Acceleration of the commercialisation of the electric vehicles, reduction of vehicle emissions, replacement of fuel oil, raising energy efficiency in terms of mobility by more than 35%. This will change the structure of the car-production supply chain and the traditional design
Road	JEMSiP_3D	Validation of technological procedures for the fabrication of high added-value mixed signal heterogeneous components and systems for system-inpackage and 3D integration	Providing the automotive systems with integrated low-cost high performance mixed-signal solutions through heterogeneous integration technologies of the system-in-package (SiP)
Road	SE2A	Targeting nano-electronics developments to enable higher fuel efficiency, lower carbon dioxide (CO2) emissions and enhanced road safety for European automotive manufacturers with a minimum impact on costs for the end user	Safe, fuel-efficient and environment-friendly vehicles
Road	LastPower	Development of high-power technologies and devices (reliable integration of advanced SiC and GaN semiconductors in power microelectronics by introducing a high quality compound material on large diameter wafers and dedicated European equipment) to ensure EU's independency in the design and production of systems for applications controlling electrical power / The project is still ongoing	Improvement of cost effective devices and design
Road	MotorBrain	Improvements in the state-of- the-art of electric vehicle drive-trains: cost reduction by as much as 25%, increase operating range by 15 to 20% through improved efficiency and weight reduction and increase security due to a distributed drive-train and improved integration / The project is still ongoing	Facilitating viability of electric vehicles by obtaining a reasonable distance per charge combined with performance to match that of a vehicle with an internal combustion engine
Road	BattMan	Design and development of battery-pack systems to manage the power feed from PV panels efficiently and deliver optimised, reliable, low-cost and predictable performance / The project is still ongoing	Development of battery technologies and management systems for electric vehicles that will be able to operate even if electricity grids are not available and will avoid further burden on a heavily-loaded electricity grid.
Road	IDEAS	Development of advanced packaging for power-supply components and new generation memory systems for applications in electric and/or internal combustion engines vehicles / The project is still ongoing	Cheaper and more reliable devices, reduced risk of thermal breakdown, enhanced safety - specially for electric vehicles and distributed propulsion systems.

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Road	MIRTIC	Development and provision of a new type of affordable low resolution sensor to overcome limitations of current single-element infrared sensors The project is still ongoing	New applications for the automotive sector (sensors around the vehicle) that will enhance safety
Road	POLLUX (Process Oriented Electrical Control Units for Electrical Vehicles Developed on a multi-system real-time embedded platform)	New electrical vehicle architectures based on distributed embedded computing and electronics system / The project is still ongoing	Energy savings, enhanced fun-to-drive, increased safety and comfort and reduction of the overall complexity of electric vehicles
Road	NES i land	Development of enabling technology and infrastructure of a modular component-based middleware for in-building infrastructures that have strong needs for deterministic dynamic functional composition and reconfiguration	More efficient, flexible, secure, safe and productive large infrastructures
Road	CARS21	Policy recommendations to support the competitiveness and sustainable growth of the European automotive industry.	Collection of the stakeholders' opinions on the automotive regulatory framework
Waterborne	SafePort Safe Port Operations using EGNOS SoL Services	Development and demonstration of an Active Vessel Traffic Management and Information System (A-VTMIS) to manage vessel movements that avoid collisions and improve the efficiency of port operations, and develop a pilot aid (SafePilot) which will ensure that harbour pilots can safely and efficiently navigate the courses provided by the A-VTMIS	Use of EGNOS for Safety of Life applications, reducing the waiting and transit times of vessels from the port entrance to their berth, and reducing docking times and improving training skills to reduce accidents
Waterborne	CoSuDEC Coastal Surveying of Depths with EGNOS to Enhance Charts	A prototype software system for processing logged raw data input to charts, a system for recruiting and managing the volunteers for the crowd sourcing, and software and hardware data loggers for use on the vessels aimed at overcome the insufficiency of data and the high costs of commissioning custom surveys on the sea bed	Use of EGNOS services for mass market of innovative applications targeted to SMEs Reduction of damage to vessels, injuries and pollution caused by going-aground-vessels
Waterborne, Rail, Road	DE-LIGHT	Promotion of the use of sandwich materials (complex lightweight modules) for ships, railway and intermodal cargo units by developing i) a multi-material sandwich design tool to evaluate and optimise the best material and structural mixes according to the requirements; ii) strategies for joining, assembly and outfitting including modular approaches for the off-line production of sandwich assemblies; and iii) testing and validation procedures / The project is still ongoing	Explore new possibilities regarding design, but also manufacturing, inspection, repair, maintenance and safety evaluations, among which we find i) deck house for inland waterway and sea cargo ships that reduce vibration and noise, costs, delivery time and weight; ii) side and deck structures for RoRo vessels & Car carriers that provide with lighter structures, better stability and modular design (facilitating transport and assembly); iii) composite (alternative) deck structures for decks and balconies that reduce costs by being lighter, cheaper, environmental friendlier and resistant to corrosion, mechanical stress and fire; iv) intermodal cargo units for freight transit with up to 30% weight reductions, durable design and higher load capacity (thus cost-efficient) and flexible thanks modular design; v) lighter (up to 40%), integrated (up to 75% fewer parts) and cheaper (up to 20% less costly) rail vehicle driver's cab
Rail, road	PRECO	Anew structure (compposite dowel) to connect steel to concret applied in the construction of bridges	Reduction of infrastructure, maintenance costs as well as of building time, and improvements in safety levels for the end user

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Rail, Air	CAMMI	Development of technologies for intelligent multi-modal interactive systems addressing the user's interaction with adaptive context-aware systems (including the development of a demonstrator to emulate operations related to a predefined set of cockpit and balance the induced workload with pilot's cognitive capability)	Flight-management systems for aircraft, UAV Vehicles, Infrastructure Management Systems and High-Speed Driver Assistance Systems in the rail domain and in large and complex industrial plants
Road, Air	Implementation of Research and Innovation on Smart Systems Technologies - IRISS (EPoSS)	The project is still ongoing	Extending competitive advantages of European industry (automotive, avionics) by means of alerting communities about the capabilities of Smart Systems as well as the provision of hubs for coordinated activity between sectors
Road, Air	Coordination and Implementation of a European Strategy on Smart Systems Technologies - CEPoSS (EPoSS)	No results could be found at the site	Efforts in developing a new public-private partnership model and recommendations provided to policy makers helping define the research and development priorities
Road, Air	MERCURE	Development of micro- and nanotechnologies based on wide band gap (WBG) materials for future communication and sensing systems / The project is still ongoing	New sensing devices capable of working in harsh environments at temperatures above 600°C for automotive, aeronautics and aerospace applications
Road, Air	NanoTEG	Taking advantage of the technical improvements offered by highly-efficient, nano-structured, thermoelectric modules that are compatible with high-volume manufacturing processes to develop and produce relevant industrial demonstrators integrating innovative and efficient cooling systems / The project is still ongoing	Improvement of the lifetime and reliability of all semiconductor devices as well as of vehicles' energy efficiency by converting waste heat into electricity
Road, Air	PARSIMO	Organisation of tools and methodologies to improve the predictive accuracy for sensitive SiP parts while reducing simulation time, reducing SiP design and time-to-market, lowering of the overall design costs and supporting an SiP ecosystem contributing to standardisation / The project is still ongoing	Enabling highly-integrated systems to be produced economically in the small to medium volumes. Typical for applications and development of smaller devices (Sensors, powerful processors, power drivers and radio-frequency interfaces) with special protection techniques to reduce sensitiveness to high voltage.
Road, Air	ACROSS	Design of a generic Multi-Processor Systems-on-a-Chip (MPSoC) and a first implementation in an FPGA that will provide a stable set of core services as a foundation for the component-based development of embedded systems with short-time-to-market, low cost and high dependability / The project is still ongoing	Creation of economies of scale of the semiconductor technology in the automotive and aerospace sector.
Road, Air	RECOMP Reduced certification costs for trusted Multi-core Platforms	Provision of reference designs and platform architectures along with the required design methods and tools for enabling cost-efficient (re-)certification of safety-critical and mixed-criticality systems necessary to increase the processing power of embedded systems / The project is still ongoing	Contribution to a cost-effective certification and re-certification of modified software. Among other applications the automotive and the aerospace are addressed.
Road, Rail, Air	iFEST industrial Framework for Embedded Systems Tools	Development of an integrated framework for establishing and maintaining tool chains for the engineering of complex industrial embedded systems with special emphasis on open tool chains for HW/SW co-design of heterogeneous and multi-core solutions, and life cycle support for an expected operational life time of several decades / The project is still ongoing	Reduction of i) time-to-market by 20%, ii) cost of poor quality by 20%, iii) the verification and certification cost by 20%, iv) cost of the system design from 2005 levels by 15% contributing to implement a cost effective design. Especially relevant for the automotive and aerospace industry, traffic solutions and railway automation.

Transport mode	Name of the project	Result/Finding	Relevance for the global competitiveness of the European transport industry
Road, Rail, Air	CESAR Cost-efficient methods and processes for safety relevant embedded systems	Bringing innovations in i) engineering through formalization of multi viewpoint, multi criteria and multilevel requirements, and ii)component based engineering applied to design space exploration comprising multi-view, multi-criteria and multilevel architecture trade-offs as well as providing industrial companies with a customizable systems engineering "Reference Technology Platform" (RTP) facilitating existing or emerging technologies integration and interoperability	Contribution to the standardization and optimization of designs will relieve regulatory constraints, decrease costs, performances and time to market deployment
Road, Rail, Air	INDEXYS	Realization of industrial implementations of cross-domain architectural concepts developed in the GENESYS, industrial grade exploitation and prototypes for validation of domain specific architectural service instantiations	Provision of real-world platform solutions
Steel industry → automotive	WAVIMETER ↓ WAVISURF	Measurement of "strip waviness" during the production process to avoid deformations and help creating a common standard for producers / The project is still ongoing	Reductions in wastage and overall costs, improvements in production phase, gains in productivity and quality improvements' worthiness are estimated at EUR 3 billion a year for the European steel industry and sales at EUR 5.4 million only within Europe
All	CHARTER	Easing, accelerating and reducing the cost of the certification of critical embedded systems by melding real-time Java, Model Driven Development, rule-based compilation, and formal verification	Cost and time investment reductions in meeting certification demands using embedded software systems while ensuring safety and security
All	I-C-EU	Understanding the relationship between transport infrastructure, competitiveness and growth; development of a methodology to quantify the impacts of infrastructure investment, include impact in assessment methodologies; and giving recommendations for European policies	Design of policies that help increase competitiveness
All	FUTURE	Identification of future challenges and demand drivers that can have a considerable impact on the global demand patterns in the passenger and the freight transport and how this might affect the competitiveness of related industries and service providers / The project is still ongoing	Finding out research strategies needs
All, Logistics	SIMPLE	Development of a novel and complete sensor and RFID based embedded middleware platform for manufacturing and logistics / The project is still ongoing	Open-source and commercial solutions capable of monitoring the state of shipments at different grouping levels (e.g., at the crate and case levels) and tracing improvements along the whole supply chain

8. Impacts of Social Security and Consumer-protection Policy (ZHAW)

One of the most important strategic visions for the European future transport sector is the EU White Paper's "Roadmap to a Single European Transport Area – Towards a Competitive and Resource Efficient Transport System" issued in 2011. The document formulates a framework for strategies and objectives for the transport sector and includes, among others, social issues such as working conditions, work safety and passenger rights.

The White Paper (2011) objectives of improving and harmonising working conditions in aviation, road and rail transport are related to furthering of market opening and creation of new rules for this situation. By opening opportunities for further education, it aims at increasing numbers of high quality jobs and the pool of well qualified workforce. Improved working conditions and communication can also prevent social conflicts and skill shortages (EC 2011 b). Therefore, working conditions should be harmonised to equalise work quality standards for all workers within EC (EC 2011 b).

Safety and security of air, maritime and land transport passengers and cargo are important areas addressed by the Paper. Both the safety and security have improved across all transport sectors since the last White Paper was published in 2001, but still a lot should be done so that Europe becomes the world leader in transport safety by 2050 (EC 2011 b). The EC (2011) has also developed an action plan for road safety which includes technology-assisted measures such driver assistance systems, speed limiters, seat-belt reminders and the vehicle to infrastructure communication. Training and education of road users and promotion of safety equipment are also essential for improving safety and security standards (EC 2011 b).

The White Paper (EC 2011 b) proposes special safety strategies for civil aviation which involve adoption of the relevant technology solutions and international cooperation. Collection, analysis and exchange of data between the aviation partners in order to identify the risks and increase safety are central parts of this strategy.

The White Paper safety strategy for maritime transport "SafeSeaNet" introduces information systems to support the maritime passengers' safety and security, and protect the environment from sea pollution. The maritime safety strategy focuses also on information sharing and creating a Common Maritime Space (EC 2011 b) which envisions establishment of dedicated safety agencies for air, maritime and rail transport and safety certification for rail transport, and strengthening the role of European Railway Agency (EC 2011 b).

The EC Green Paper (EC 2006/C275) preceded the common European maritime strategy which promotes economic, ecological and social importance of seas and oceans. The document has also reviewed maritime working conditions and considered them essential for competitiveness of European maritime sector. Highly qualified crews and shipping professionals are crucial for the maritime industry's survival and maintaining of Europe's competitiveness. Hence, impressions of insecure job, poor working conditions including wage issues are making maritime sector a less attractive employer (EC 2006/C275). It observes, however, that global competitive pressures on

shipping industry reduce the seafarer' wage levels, despite the fact the highly educated seafarers are not available at low pay (EC 2006/C275).

Inspections of working conditions in maritime industry are often performed by authorities offshore (EC 2006/C275). Depending on the country, these controls are either allocated to a single authority or several different bodies. Thus, in order to improve the quality of controls and to make them simpler and more efficient, better coordination of control activities between MS is required (EC 2006/C275).

8.1 Main Social and Safety-related Policies

8.1.1 Working conditions

Below, several European directives and regulations on working conditions in road, rail, maritime and air transportation are discussed.

Working conditions in road transport are regulated by several sector-dedicated directives. The Regulation no. 2006/561/EC on harmonization of social legislation in road transport aims at improving working and safety conditions in road transport through harmonization of conditions for competition between the different transport sectors (EP & Council 2006/561). The Regulation also defines working hours in the mobile road transport activities. A limit for maximum working hours for the mobile workers and guarantees for adequate breaks and rest periods during working days should be adopted by all Member States (EP & Council 2006/561). It also requires access to information on regulations concerning working conditions for all professional drivers working for public and private employers (EP & Council 2006/561).

The directive no. 2002/15/EC addressing working conditions in road transport (EP & Council 2002/15) sets out clear limits for the numbers of weekly working hours, which regularly cannot exceed 48h. The daily working time should not exceed 10 hours and the night time work is defined. In case the requirements aren't obeyed, penalties will be applied (EP & Council 2002/15).

Another directive no EC/1071/2009 establishes common rules for working conditions for goods and passenger road transport operators. Since common rules for transport operators have been inconsistently applied, working conditions throughout the EU have not yet been harmonised (EP & Council 2009/1071). In addition to working conditions, these rules also include safety regulations for roadworthiness of commercial vehicles as well as driving license requirements (EP & Council 2009/1071).

Several directives regulating working conditions in railway operations have been issued. The rail Directive no. 2005/47/EC defines fundamental working hours for rail transport sector when it comes to international, cross-border services in Europe. The daily driving time limits are set to 9 hours whereas 8 hours are allowed for the train drivers' night shifts. A break between 30 and 45 minutes needs to be included into duration of a full working day (Council 2005/47).

Directive no. 2007/59/EC focusing on train drivers and operating systems in the Member States also defines working conditions for cross-border activities (EP & Council 2007/59). The directive requires that it should be communicated throughout the sector to reach the current, new and the future employees. It requires that training by computer-simulated working-by-doing learning scenarios should be offered to rail workers in order to prepare them for how to handle accidents and incidents. Furthermore, in order to improve working conditions and rail safety the directive defines proper working methods, safety rules and learning situations in addition to personal and professional needs of train drivers (EP & Council 2007/59).

Additionally, directive no. 2008/57/EC deals with interoperability of the Community's rail system and harmonization of rail sector's working conditions. It also includes requirements for staff qualifications, safety and hygiene conditions (EP & Council 2008/57).

Working conditions in aviation sector are also regulated by the directive 2000/79/EC which defines the terms for working times, the annual leave as well as the health and safety protection. The aviation staffs is entitled to a minimum of four weeks paid annual leave and the maximum annual working time should not exceed 2,000 hours (Council 2000/79).

To improve and simplify access to social security for aircrews including air hostesses, stewards and pilots, the EC created rules for aircrew and cross-border workers (EC 2012 e). The rules are based on Regulations 2004/883/EC (EP & Council 2004/883) and 2009/987/EC (EP & Council 2009/987) amended by Regulations 2012/465/EU (EP & Council 2012/465) and 2010/1244/EU which seek to harmonise the social security systems between the MS. The Regulation (EC 2010/1244) focuses on national and country-specific aspects of social security and working conditions. It clarifies applicability of social security legislation of the home-base country for air crew workers in cross-border activities and states that legislation of a country where the crew starts and ends their shift applies to the aviation employees instead of a country where the airline is based (EC 2012 e). The Regulation also aims at improving the unemployment benefits for the aviation workers (EC 2012 e). In addition to Green Paper several other legal acts determine working conditions in European maritime sector. Directive no. 2009/13/EC on maritime labour convention includes principles for healthy, safe and dignified working conditions and limits the maximum working time. It reiterates that every maritime sector worker should be entitled to a workplace with high safety standards and social protection and defines rest-periods, annual leaves and requirements for medical certificates of seafarers (Council 2009/13).

To ensure the enforcement of directive 2009/13/EC an EC communication COM 2012/134 was issued which proposes control requirements for the flag and the port states in order to ensure implementation of 2009/13/EC (EC 2012/C134).

A proposal for Directive no. 2012/129/EC concerning the MS ports state-control, amended by Directive 2009/16/EC sets out the requirements for working and living conditions on board of ships with an intention to make them function as marine labour code worldwide because its implementation will better working conditions for all seafarers even those on board of the non-EU flagged ships (EP & Council 2012/129).

Directive no. 2008/106/EC focuses on requirements for training of seafarers on the EU flagged ships. The directive sets standards for training of seafarers and recognizes requirements used in non-EU countries; it also prescribes inspections of maritime training systems in order to secure the compliance with its own standards (EP & Council 2008/106). Several other policy measures, such as Regulation no. 2009/391 (EP & Council 2009/391), Directive no. 2009/21 (EP & Council 2009/21) and Directive no. 2009/16 (EP & Council 2009/16), focus on safety of marine environment and pollution prevention in addition to indications for the quality of on-board working conditions.

8.1.2 Safety and Consumer Protection

In an attempt to develop single, high-quality and competitive European transport market, the following directives and regulations affect transport-related safety and consumer protection in the EC.

A Directive proposed by the EC in COM/2008/0151 on the "Cross-border enforcement in the field of road safety" focuses on bilateral agreements against road traffic offences committed in another EU member state than the one where the vehicle is registered. A central part of the directive is an improved system for exchanging information between the member states and it especially focuses on offences regarding surpassing speed limits, alcohol levels in blood and the non-use of seat belt as well as failures on stopping at red traffic lights. It aims for a further reduction in the number of road accidents through better driving habits and stricter observation of existing legislation (EC 2008/C151). A Directive was adopted in 2011 (2011/82/EU).

When it comes to public road transport, Regulation no. 2011/181/EU aims at higher protection of passengers in bus and coach transport. In case of cancellation or delayed journeys the passengers should be informed and their tickets reimbursed or re-routing organized. The Regulation (EP & Council 2011/181) also declares that persons with reduced mobility and disabled persons have the same rights to transport services as any other passengers and a free choice and access to transportation should be guaranteed. It also includes improving the existing infrastructure and building new one in an attempt to make it adapted to special user needs (EC 2011 b). In case of accidents adequate assistance has to be provided, including the first aid, accommodation, clothes and transport (EC 2011 b).

Another consumer protection policy act, communication COM/2007/99, seeks to improve coordination between the different policies and integrate the legislation on consumers' interests in non-food service provision sectors areas such as health, energy, transport and environmental protection (EC 2007/C99). Air transport is mentioned with a goal to spread the passenger rights from aviation sector to other modes, especially when it comes to passengers with reduced mobility (EC 2007/99).

Regulation no. 2007/1371/EC on rail passengers' rights and obligations introduces passengers' rights to adequate travel information before and during a journey and entitlement to compensation in case of delays, missed connections or travel cancellations. It also commits service providers to

ensure safe journey through deployment of personal security measures at stations and on board of transfer vehicles (EP & Council 2007/1371). The same Regulation also requires that free access and assistance to persons with reduced mobility or disabilities which travel by train is guaranteed in all MS. Overall, these measures seek to increase number of rail passengers and improve rail competiveness in relation to road, air and maritime travel.

Directive no. 2008/110/EC on safety of the EU railways provides common regulatory framework for establishment of single market for rail transport (EP & Council 2008/110). Since deployment of concrete safety measures is more effective at community level, it decides that maintenance of rail vehicles would rather be performed there than at state level.

Regulation no. 2010/1177/EU provides legal framework for protection of maritime passengers, also in ports located outside the EC, and for rights of passengers travelling by sea and inland waterways. The maritime transport services should also be accessible to people with reduced mobility, and in case of cancellation or delay a reimbursement should be paid (EP & Council 2010/1177). The connections between maritime modes and public terrestrial transport services need to be improved to promote more sustainable, multimodal transportation.

Several other directives regulate safety and consumer protection in maritime sector. Directive no. 2010/36/EU lies out safety standards for passenger vessels including the maximum speed limits for ships and regulates navigational equipment (EC 2010/36). Directive no. 2011/15/EC deals with incidents on sea and safety of seafarers on board of vessels, and with passengers and persons on shore and in marine environment. Safety measures prescribed by directive (EP & Council 2011/15) involve information and monitoring systems such as automatic identification systems and voyage data recorders. The directive maintains that, in order to further improve the maritime safety, more precise requirements for information systems would need to apply also to smaller passenger vessels (EP & Council 2011/15). The Directive no. 2009/18/EC and Regulation no. 2009/392/EC formulate passengers' rights and safety measures in case of accidents on sea. Preventive measures which enhance maritime safety and reduce accidents are the first priority specified in Directive 2009/18. The directive requires that in case of an accident, a thorough investigation needs to be conducted to understand the dangerous causes and prevent future incidents while at the same time fair treatment and the rights of seafarers and passengers have to be observed (EP & Council 2009/18). When it comes to passengers, it is essential to provide adequate information and insurance (EP & Council 2009/392). If passengers' luggage gets damaged or lost, compensation needs to be given. The regulation provides detailed information on circumstances under which some forms of compensation are liable (EP & Council 2009/392). Besides, directive, 2009/20/EC, defines insurance procedures for ship owners to ensure responsible operations and protection of victims in the case of an incident. The directive also states that insurance procedures are more appropriate and efficient when applied at community level rather than at national or EU levels (EP & Council 2009/20).

Regulation 2009/1108 (EP & Council 2009/1108) on safety of airport operations including air navigation services and Regulation 2010/996 (EP & Council 2010/996) on fundamental principles for investigation of civil aviation incidents and accidents represent the two policy measures

addressing safety and passenger protection in aviation sector. The deployment of Aviation Safety Management System for Europe and the Asynchronous Transfer Mode (ATM) as formulated by the Communication (EC 2011/C670) will improve data collection and data transfer, and by so doing also safety conditions in air transport.

By steadily reducing the accident occurrence, the Safety Management System aims at making the European aviation sector the world's safety leader. Attainment of these goals may enhance the sector's global competitiveness (EC 2011/C670). However, one great challenge that European aviation sector faces today is its continuous growth and the fact that it becomes increasingly more complex (EC 2011/C670).

8.2 Impacts on Transportation Industry by Sector

Studies, articles and press releases assessing impacts that the European legislation regulating working conditions, safety and consumer protection in transport industry have invoked on global competitiveness of European transport industry are reviewed in following chapters. The analyses are done separately for rail, road, waterborne and air transport.

8.2.1 Rail

Direct impacts of regulatory legislation

A study called "Review of the Common Transport Policy" analysed several European transport policies and their impacts on safety, security, passenger rights and working conditions (Steer Davies Gleave 2009 a). Since the market share of railways was declining, an important objective of the White Paper from 2001 was to increase railway transport through introduction of more fair competition between the transport modes (Steer Davies Gleave 2009 a). Although this target was not yet reached, a net decline in rail freight transport was stopped. A slight shift towards rail has, however, occurred on long distance trips or on lanes with high congestion levels, which means in market segments where such shifts were welcome (Steer Davies Gleave 2009 a).

By harmonizing safety regulations, introducing common requirements and enforcing common procedures in case of accidents or incidents, the EC wants to enhance safety in rail transport (Steer Davies Gleave 2009 a). Indeed, the European rail sector has experienced fewer accidents. However, in addition to policy measures, this achievement was mostly related to installation of traffic monitoring systems, application of innovative ICT and other technical safety solutions, and bigger role of the European Rail Agency (Steer Davies Gleave 2009 a). Improved level of rail safety may contribute to competitive advantage of rolling stock and rail equipment manufacturers, although safety measures have implementation costs. The benefits from reduced rail accidents, improved image and more attractive transport services might be however larger. Besides, the existing binding regulation with regards of safety standards may reduce operational costs for international service providers and production costs for rolling stock manufacturers and other rail equipment suppliers, as they only need to comply with one set of European laws.

When it comes to passenger rights in rail sector, the European directives apply only on international

services, which are a small part of the total demand for rail transportation in the EC. The Member States then have up to 15 years to implement the directives at domestic level, which makes the impacts assessment quite challenging (Steer Davies Gleave 2009 a).

A European Commission's study examined passenger rights in urban public transport by road and rail. The paper mentions numerous European, international, national and regional directives and regulations focusing on public transport passenger rights. It states that a thorough overview over these legal acts is needed to create a consistent and competitive European transport sector. A customer-oriented system which provides adequate information on passengers' rights should also be created (EC 2012 f). Although compliance with passenger rights might in the short-run inflict additional costs on service providers, still adherence to these regulations may improve the European rail sector competitiveness because of higher quality of rolling stock and information systems.

Compensation in case of incidents and real time information to passengers also increases the attractiveness of rail and stimulate passengers to choose to train for more frequent travel.
The European directives and regulations authorised the passengers to right for compensation for inconvenience in public transport (EC 2012 f). For example, in case of cancellations or drastic delays most of the Member States do offer reimbursement, re-routing or other mobility alternatives for public transport users, including rail traffic passengers (EC 2012 f). These measures however differ from country to country and their implementation is inconsistent, partly due to the existence of diverse directives and the lack of one consistent European railway regulatory framework. This can act as an additional burden on rail operators of international services and manufacturing industries which deliver to international clients. On the other hand, diversity of standards may act as a competitive advantage when supplying rail industries with equipment and vehicles in global markets because they are used to complying with different requirements.

Research impacts and industrial outcomes

There have not been many EU projects dealing with impacts that the quality of working conditions in transport induces on the industry's competitiveness as compared to other factors. An EU FP7 project called FUTURAIL analysed the scope of training, skills and innovative solutions in the European railway sector and concluded that a better match between the human resources and the skills developed by education and training is needed. The FUTURAIL project also emphasized the need for investing in research and development and in innovative technological upgrading to enhance the competencies in rail sector (FUTURAIL 2011). New technical solutions as well as talented and skilled staff would help in facing future challenges and lead to a more competitive and innovative rail sector (FUTURAIL 2011). The global competitive advantage would especially be created through innovative solutions which would lead to a more efficient rail sector and could also be applied to other markets, creating export possibilities. Qualified work force is another advantage which additionally leads to improved rail safety. The costs of training and research investments can be seen as negative aspects, even though these measures have a positive influence on long-term competitiveness.

Another project called SKILLRAIL has similar focus as the FUTURAIL and aims at improving

education and training for railway workers (SKILLRAIL 2010). As mentioned, qualified staff is a competitive advantage for the European rail sector and the recommendations of the SKILLRAIL project would contribute to that. The SKILLRAIL project also included a specific EURAIL framework for creation, dissemination and transfer of knowledge within the European railway sector (SKILLRAIL 2010). More exchange of experience and solutions might create synergies between rail service providers and other stakeholders making rail more efficient.
It should however, be kept in mind that these research projects only may produce positive effects on rail industry's global competitiveness if their results and recommendations are implemented.

8.2.2 Road

Direct impacts of regulatory legislation

The study on "Review of the Common Transport Policy" analysed several European transport policies and their impacts on safety, security, passenger rights and working conditions in road transport sector (Steer Davies Gleave 2009 a). One of the main objectives of the EU White Paper from 2001 was reduction of road fatalities. During 2001-2010 a reduction of 29% was reached and a trend towards further road fatalities reduction could be seen (Steer Davies Gleave 2009 a). The effectiveness of directives dealing with safer road traffic depends completely on Member States and their efforts to implement these policies (Steer Davies Gleave 2009 a). According to the Policy Review (Steer Davies Gleave 2009 a) the safety of motorcyclists should be especially improved since the trend for motorcycle accidents is rising. The protection of weaker road users (young people, elderly) should be another priority for the future (Steer Davies Gleave 2009 a).

The safety standards used by European road vehicle manufacturers in addition to other safety regulations influence the motor vehicle industry's competitiveness. If implemented, they may increase demand for European passenger cars, motorcycles and heavy-duty vehicles and create an international advantage for European producers. The safety measures generate implementation costs, but at the same time they prevent accidents and reduce external and social costs of transportation. By so doing, they have high social utility.

When it comes to working conditions in road sector, there have been some improvements in the past due to policy implementation. For example, training conditions for professional road drivers have improved and its quality has also improved, even though implementation of the policy measures haven't been mandatory (Steer Davies Gleave 2009 a). The measures relating to improved drivers' training have also improved road traffic safety and reduced occurrence of fatal accidents (Steer Davies Gleave 2009 a). The impacts of Directive 2002/15/EC aiming at improving working conditions were also analyzed. It has turned out that besides training, also monitoring of working and driving hours performed by persons in road transport led to less overtime (Steer Davies Gleave 2009 a). One can thus surmise that better qualified and satisfied work force with rights to adequate breaks and annual leaves, will generally contribute to road safety. Regulations and directives which improve working conditions may also improve competitive standing of European transport equipment manufacturers.

A study by Goths et al. (2012) analyzed impacts induced by the road transport safety policy (Goh &

Love 2012). The impacts of policy measures supporting purchases of vehicles with higher safety standards and the effects of public transport subsidies on the number of road accidents were investigated. The policy impacts depended on which regions had the highest benefits from subsidised public transport. The subsidies reduced traffic volumes due to increased usage of public transportation and thereby improved the traffic safety. Reduced private transport volumes reduced accidents, improved safety and lowered external costs of transportation. By so doing, transport subsidies enhanced the scope of social benefits for Europe.

The directive no. 2002/15/EC on working conditions aimed at regulating and improving working hours and conditions in European road transport sector. Since the European labour market is regulated and the directive influences the entire European road transport sector including service providers from outside Europe, it does not have any influence on global competitiveness. Only when it comes to providing European transport services to emerging markets, the costs arising from implementation of better working condition and safety regulations can be of disadvantage.

The Regulation no. 2011/181 on bus and coach passenger rights applies since 1st of March 2013, but its ex ante impact in form of monetary and non-monetary benefits was approximated before it was implementation. The Regulation seeks to improve accessibility for people with reduced mobility and disabled people, and also, practical assistance and compensation for passengers in case of accidents or other incidents (EU 2011 b). If the EU Regulation increases the amount of low floor and other barrier-free vehicles in Europe, the competitiveness of vehicle providers can be improved as compared to those who do not manufacture such equipment (EU 2011 b). These vehicles might also become good export items outside Europe and through that, strengthen the European transport industry.

A study by the European Commission focusing on passenger rights in urban public transport also considered public transport such as busses, trolley busses and taxis (EC 2012 f). One of the main issues with the policies and regulations dealing with consumer rights in road transport is the low awareness among the passengers about their rights. Due to this, passengers do not make full use of their rights and, hence, impacts of passenger rights policies remains low (EC 2012 f).

Research impacts and industrial outcomes

Several projects are financially supported by the European Union to improve safety performance. They do not only further support objectives targeted by European policies but may also improve the competitiveness of the European automotive industry.

For instance 2WIDE_SENSE[100] (WIDE spectral band & WIDE dynamics multifunctional imaging SENSor Enabling safer car transportation) researches how to overcome current limitations of Intelligent Vehicle Systems related to performance and cost of sensor technologies. More specifically the project aims at providing the European automotive industry with the next generation of imaging sensors beyond the current CMOS imagers. The core sensing technology is a cost-

[100] For more information, see http://cordis.europa.eu/projects/rcn/93770_en.html

effective InGaAs focal plane array with wide spectral response (VIS-NIR-SWIR) and wide dynamic range (120dB). The benefits deriving from the additional SWIR bandwidth allow enhancing preventive safety functions and car energy efficiency. As a result the project not only contributes to reducing the number of road casualties but also to improve energy performance and reduce costs.

By showing citizens how to slow, the SHLOW[101] project (show me how slow) aims at raising the citizens awareness on the link between safety and sustainability and how speed management represents a major aspect in preventing road casualties and protecting the environment.
On the one hand, speed which encompasses excessive speed (i.e. driving above the speed limits) or inappropriate speed (driving too fast for the prevailing conditions, but within the legal limits) contributes to one third of fatal accidents and aggravates its severity, with particular risks to vulnerable road users such as pedestrians and cyclists. On the other hand, speed reduction mitigates the negative environmental impacts of transport. By raising the awareness, this project may facilitate the adoption of binding measures to reduce the maximum permitted speeds and, thus, may change the type of vehicles demanded by consumers. The European automotive industry may benefit from this if the development of such vehicles and the policies that underground such consumption changes are coordinated and keep the same pace.

The objective of another project, ASPECSS[102] (Assessment methodologies for forward looking Integrated Pedestrian and further extension to Cyclists Safety Systems), is to contribute towards improving the protection of vulnerable road users, in particular pedestrians and cyclists by developing harmonized test and assessment procedures for forward looking integrated pedestrian safety systems. The outcome of the project will be a suite of tests and assessment methods as input to future regulatory procedures and consumer rating protocols. Implementation of such procedures / protocols will enforce widespread introduction of such systems in the vehicle fleet, resulting in a significant reduction of fatalities (30% pedestrians; 20% cyclists) and seriously injured (50% pedestrians; 20% cyclists) among these vulnerable road users. This project is again in line with policy objectives defined by the EC and gives the European automotive industry additional support to produce safer vehicles.

8.2.3 Waterborne

The EC defined strategic goals and recommendations for long-term competitiveness of the future maritime transport, and the entire European shipping industry in general. These goals encompass roadmaps for shipping in clean oceans and seas, and also for how to face the looming 21st century challenges (EC 2009/C8). The EC suggests that an integrated approach based on values derived from sustainable development and high social standards should be used by industry within Europe and also beyond to improve the maritime industry's safety, security and sustainability standards. Stakeholder involvement and constructive dialogue with stakeholders are essential for implementation of safety measures (EC 2009/C8). More safe and secure European maritime service providers may acquire competitive advantage over those with lower performance on both parameters.

[101] For more information see http://cordis.europa.eu/projects/rcn/89642_en.html

[102] For more information see http://cordis.europa.eu/projects/rcn/99619_en.html

Direct impacts of regulatory legislation

The EC regulations and corresponding measures for the maritime sector focus also on elimination of maritime pollution through promotion of double hull tankers, use of shore-side electricity and imposition of sanctions for pollution. When it comes to passenger rights, regulations similar to rail and air passenger transport need to be developed (Steer Davies Gleave 2009 a). Another important issue with the maritime regulations is its complexity. The international, national and regional regulations need to be harmonized and simplified in order to create a maritime space without barriers and improve competitiveness of European maritime sector (Steer Davies Gleave 2009 a).

Regulations aiming at improving working conditions in European maritime sector have been less successful for making the industry an attractive employer since the amount of Europeans working in maritime jobs has been declining. Also, implementation of controlling schemes for monitoring working conditions and other maritime operations were lacking (Steer Davies Gleave 2009 a).

If the recommendations of directive no. 2009/18/EC focusing on passenger rights and safety measures are implemented, they might enhance competitiveness of the maritime passenger transport in Europe. By improving quality of service and passenger satisfaction the directive may increase demand for maritime travel offered by European vs. Asian operators.

Research impacts and industrial outcomes

The impact of transport policies on competitiveness of the European sea transport sector was also analysed. For example, the FP7 projects EUROSUR SeaBILLA (SeaBILLA 2013) and GOALDS (GOALDS 2013) both aimed at improving maritime safety in line with the EU maritime policy's goals and that stated in Green Paper (EC 2006/C275). The SeaBILLA project worked on improvement of sea travel safety through design and installation of new sea border surveillance systems. It also focused on enforcement of passenger rights within the European sea borders. The project called GOALDS focused on integration of collision and grounding elements, the risk-based derivation of new subdivision requirements and a series of concept design studies designated for improving safety and practicability of new solutions (GOALDS 2013).
In case the recommendations of these two projects are implemented, the safety on sea could be improved, and the amount of accidents reduced. This may differentiate the European maritime sector from other manufacturers through good safety standards. Still, the implementation of safety measures has costs, but the benefits from increased safety standards may enhance the competitiveness of European maritime sector.

The SAILAHEAD and UniMET EU-funded projects represent the European lifelong initiatives aiming at improving training and education for marine staff and sea captains in line with international requirements. The idea is that the shortage of skilled seafarers in Europe can be reduced through training. Skilled personnel may also be capable of performing more challenging tasks and receiving better job opportunities (SAILAHEAD 2013). Training may increase the employability of the European marine staff in international labour market and by so doing better

meet the needs of local and national maritime industries (UniMET 2013). Another two projects named CAPTAINS and MarTEL Plus seek to improve international communication and maritime safety by using English instead of national languages for training the seafarers.

8.2.4 Air

Direct impacts of regulatory legislation

When it comes to impacts that the European transport policy induced on competitiveness of air transport sector, passenger security and passenger rights are the two indicators of success (EC 2013 b). Regulations imposing compensations for cancellations or delays and measures to counteract chaotic situations at airports when delays occur, were implemented by all Member States (EC 2013 b) during the last years. Still to reach further improvements, a more specific legislation is necessary. Improvement of passenger rights in air transport is much more important than in railway or maritime sectors because customer satisfaction is an important competition factor in fight for passengers with non-European airlines.

Assessment of true impacts of air sector regulations and directives on aviation safety is difficult because few Europe-wide reliable data are available on previous occurrence of incidents, close-call situations or accidents. The data collected by few Member States show an unchanged accident trend despite of increases in traffic volumes (Steer Davies Gleave 2009 a). Proper data collection and information exchange between airlines may improve safety performance. Efficient communication may also prevent future accidents. Better communication may save direct and external costs and, also compensate for extra money spent on data collection and exchange. These efforts may strengthen global competitiveness of European aviation industry.

Regulations 2009/1108/EC (EP & Council 2009/1108) and 2010/996/EC (EP & Council 2010/996) aiming at better management of air safety through in combination with Regulation 2000/79/EC on working conditions may impose additional costs on airlines in the short to medium-terms. However, improved working quality may in the long time lower the risk for overburdened employees, which is particularly important in sector where safety is a critical factor.

Research impacts and industrial outcomes

Several projects have also been supported by the European Union in the field of aviation so as to ensure customer satisfaction and safety. The following projects are extracted from a document that gathers projects in aeronautics and air Transport Research within the 7th Framework Programme (EU 2012).

AIRCRAFTFIRE (Fire-risk Assessment and Increase of Passenger Survivability) researches how the increased use of composites in the manufacturing of new generation aircrafts may affect fire risks of flammability and fire spread velocity. The aim of the project is reducing that impact to increase the survivability of passengers. But to do this the project will conduct experiments and evaluate several issues such as the efficiency of new multi-criteria fire detectors and suppression systems and provide aircraft designers and manufacturers with tools for predicting fire growth

and improving passenger evacuation. This will not only help airlines to fight fires and save lifes but also reduce false alarms, thus preventing human and economic losses.
Designers may also use expected design the tools and methods developed by the ARISTOTEL (Aircraft and Rotorcraft Pilot Couplings – Tools and Techniques for Alleviation and Detection) project with reagards oscillations in aircraft and rotorcraft, so that such oscillations can be use when they serve to improve the operational effectiveness of the flight but detect and prevent when they may cause the loss of aircraft and lives.

SMAES (Smart Aircraft in Emergency Situations) aims at developing a set of simulation tools that will permit cost-eff ective design and entry-into-service of aircraft able to protect passengers in ditching emergency situations. The expected results will not only improve air safety but also reduce costs related to aircraft development (design), safety validation tests and accidental losses.

SVETLANA (Safety and maintenance Improvement through Automated Flight-data Analysis) targets at improving the analysis capacity of the flight-data monitoring, and thus, extracting the best and most information out of it. Among others, objectives are to improve the maintenance support, reduce human intervention. This might increase safety levels of air services as well as improve the operational efficiency of airlines. However, as the project is an EU-Russia co-operation, also non EU carriers may benefit from these outcomes.

8.3 Assessment of impacts

As mentioned, the European regulations and directives aiming at bettering of working conditions, safety and customer protection in the transport sector have invoked variable impacts. Transport safety and passenger rights have improved, but regulations are complex, implemented at different levels and some may collide with national and regional laws. This may hinder creation of a single, competitive European transport market. However, when regulations concerning passenger rights and transport safety are implemented, they may considerably improve the quality of transport services and competitive advantage of European operators.

The impacts of EU legislation on rail transport are difficult to assess since they often apply to international services only. Furthermore, the Member States have a long time to implement them on national levels. The direct impacts on improvement of rail safety are also difficult to evaluate since there is no accident records from time preceding these laws. Even though the safety has improved and the amount of accidents reduced, the reasons for this are not the EU regulations only but also national and regional policies and measures, and generally better technology solutions and traffic control systems. Yet, it might be reasonable to conjure that regulations sped up implementation of advanced technological solutions, which again can be exported, and earn extra revenues from abroad. This might also strengthen the European manufacturers' position in global markets for railway traffic management systems, rolling stock and traction equipment.

When it comes to effectiveness of directives aiming at improving road safety which sought 50% reduction of fatal accidents during 2001-2010, this goal was not completely achieved. However, a reduction of 29% was attained, and an on-going trend towards fewer accidents could be observed (Steer Davies Gleave 2009 a).

The impacts of directives on customer protection and safety in transport sector have improved the passenger rights in case of accidents, delays or other incidents. Different forms of compensations have already been introduces in rail and air transport, without however similar results in maritime sector. The requirements of improvement of working conditions in maritime sector haven't either produced the desired effects so far. The European directives and regulations have, however, facilitated access to transport services in air travel and land and water modes for passengers with reduced mobility and disabilities, which may translate into production of more passenger-friendly transport equipment.

8.4 Summary of impacts

The transport-related directives and regulations which impose higher safety standards and improve working conditions can enhance the European competitiveness versus operators from countries with less stringent legal requirements. At the same time, however, existence of multiple domestic laws and international accords and directives which are enforced by regional, national, and international authorities creates a complicated regulatory environment which needs harmonization.
The complex legislation composed of many directives can occasionally create barriers for the national transport industries because European directives override local laws and may lead to changes in production and service conditions at national levels. It does not mean, however, that local laws have been worse or less strict, but that they might have focused on different factors.
Yet in general, most of the EU directives and regulations strengthen competitiveness because they lead to more homogeneous European transport market. For example, regulations on consumer protection unify the users' status within the European transport sector, simplify the rules and offer more customer protection than some national laws did before. High protection of passenger rights improves attractiveness of European transport sector and service quality. This is particularly relevant for European aviation which is highly exposed to rivalry from non-EU airlines. The quality improvements may also increase demand for transport services. When it comes to the maritime sector, further improvements in passenger rights and working conditions are still needed to strengthen the sector's competitive position. All these measures come with costs, which can be a disadvantage when competing with non-European providers. On the second glance, however, as the level of traffic and competition grow, the safety issue and passenger rights are becoming more important for all customers. As observed, airlines and rail carriers have lost customers after serious accidents. Dissatisfied customers due to delays or loss of luggage may also shift not only transport provider or mode but also share their negative experience with other potential users.
An advanced and highly safe European transport is the main goal of European Community, which might also become more globally competitive. The Community regulators want a single transport market and transport sector is an important measure to achieve just that.

Table 15: Summary of impacts of policies related to safety and consumer protection

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Rail, road and inland waterways	Strengthening of national laws outside of safety issues (Dangerous goods)	Directive 2008/68/EC	A common regime for the entire European inland transport of dangerous goods, by road, rail and inland waterways within the European Union (EU). EU countries have the right to regulate or prohibit transport of dangerous goods, strictly for reasons other than safety during transport, within their own territory. They may also set down specific safety requirements for the national and international transport of dangerous goods within their own territory.	Existence of national regimes weakens European competitiveness, because different national regulations may vary as regards definitions of dangerous goods and the needs for protection. (if the common regime is adopted it will standardize the operations and inspection procedures).
Rail, road and inland waterways	Strengthening of national laws outside of safety issues (Dangerous goods)	Decision 2011/26/EU	To establish special permits for EU member countries (more detailed. additional Decision to Directive 2008/68/EC)	Loss of competitiveness, because multiple instances of law must be considered. More rights for domestic laws complicate the creation of single market.
Rail	More competitive and safer railway system in Europe (Rail Safety)	Directive 2008/110/EC	To establish a more competitive and safer railway system which covers the entire European market by setting up, in each Member State, an authority responsible for safety control and supervision; Mutual recognition of safety certificates between the Member States, establishment of common safety indicators (CSIs) to assess whether a given system complies with the common safety targets (CSTs) and facilitate monitoring of railway safety performance; Definition of common rules for safety investigations. In order to access railway infrastructure, a railway undertaking must hold safety certificate.	Strengthen competitiveness by harmonizing policies
Road	Safety of transportable pressure equipment, free movement within the European Union (Safety)	Directive 2010/35/EU	Achieve mutual recognition of safety certificates delivered for transportable pressure equipment: all pressure receptacles, their valves and other accessories when appropriate; tanks, battery vehicles / wagons, multiple-element gas containers (MEGCs), their valves and other accessories when appropriate; includes gas cartridges but excludes aerosols, open cryogenic receptacles, gas cylinders for breathing apparatus and fire extinguisher	Detailed rules for pressure equipment reduce the risk for environmental disasters. In addition, the free movement in all MS will be achieved. The competitiveness of all companies that produce pressure equipment may be strengthened significantly
Maritime	Harmonizing the legal framework for inspections, surveys and the certification of ships. (Maritime Safety Package)	Directive 2009/15/EC	To harmonise the legal framework for organisations carrying out the inspection and certification of ships as well as their relationships with the competent authorities in Member States. - A Member State may only entrust duties of inspection, survey, allocation or renewal of certificates for ships flying its flag to recognised organisations - A Member State may not refuse authorisation for recognised organisations	Strengthen competitiveness by harmonizing former restrictions

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Maritime	Legal framework recognition and activities of organisations responsible for carrying out ship inspections and surveys. (Maritime Safety Package)	Regulation (EU) No 391/2009	Harmonisation of regulations and procedures applicable for organisations carrying out ship inspections and surveys will improve maritime safety and environmental protection through creation of independent quality assessment and certification entity need to be set up by 17 June 2011.	The same Regulation for all MS and a recognised organisation for all countries in the EU guarantees better cooperation and may enhance competitiveness
Maritime	Integrated maritime surveillance for maritime safety and security (Surveillance of maritime domain)	COM (2009) 538/ COM (2010) 584	Maritime surveillance as a tool towards optimisation of information exchange between the different user communities. - building a non-hierarchical technical framework - exchanging information between civilian and military authorities - removing obstacles to the exchange of information imposed by specific legal provisions	Strengthen competitiveness by harmonizing former restrictions and creating common legal framework
Maritime	Legal framework to improve the performance of Member States as flag States. (Maritime Safety Package)	Directive 2009/21/EC	Ensuring that Member States fulfil their responsibilities as flag states more effectively and more consistently. Furthermore, it aims to improve maritime safety and prevent pollution from ships flying the flag of a Member State.	Member States as one flag state leads to standardization and harmonisation and supports competitiveness
Maritime	Improving compliance with international and Community rules through common rules on port state control of ships. (Maritime Safety Package)	Directive 2009/16/EC	To make maritime transport safer by reducing the number of ships circulating in the territorial waters of the European Union which do not comply with existing safety standards by means of - Harmonising the training and assessment of inspectors' competences - Allocating a risk profile to a ship - Access refusal measures concerning certain ships - Rectification and detention	Strengthen competitiveness by harmonizing former restrictions
Maritime	Prevent accidents and pollution at sea (Maritime Safety Package)	Directive 2009/17/EC	To broaden the scope of former legislation by additions to Directive 2002/59/EC: - AIS also for smaller boats - some exceptions were cancelled, some others were added	Interconnection and interoperability helps to make faster decisions and supports competitiveness.
Maritime	Prevent accidents and pollution at sea (Maritime Safety Package)	Directive 2011/15/EU	Additions to Directive 2009/17/EC: - smaller boats have to be upgraded with AIS - some more exceptions were cancelled, they also need AIS to be added	Interconnection and interoperability helps to make faster decisions and supports competitiveness.
Maritime	Harmonised regime of liability and insurance for the carriage of passengers (Maritime Safety Package)	Regulation (EC) No 392/2009	To introduce one Community regime of liability and insurance for carriage of passengers by sea in order to improve compensation for passengers who suffer damages and improve safety of maritime transport.	Consumer protection, which increases operations costs for service providers.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Maritime	Legal framework to the insurance of ship owners (Maritime Safety Package)	Directive 2009/20/EC	To provide legal framework for insurance of ship owners for maritime claims in order to make economic operators act more responsibly and improve the quality of merchant shipping. Member States shall ensure that ships anchored in ports under their jurisdiction have a certificate of insurance.	European ports shield against uninsured ships. This ensures that the ports of the Member States are protected against big damages.
Maritime	Safe Seas and the Prevention of Pollution from Ships (Oil tankers)	Regulation (EC) No 1163/2009	Provide new definitions in accordance with opinion of the Committee on Safe Seas and Prevention of Pollution from Ships - e.g. a new definition for heavy diesel oil/ fuel oil - the meaning of double-hull oil tanker was added	New consumer protection laws and safety prescriptions for boats were introduced since the meaning was not right.
Maritime	Directive on safety rules and standards for passenger ships (safety)	Directive 2010/36/EU	Provide with a new classifications for safety rules and standards for passenger ships regarding: - Scope - Classes of passenger ships - Application of safety rules and standards - Safety requirements - Additional safety requirements, equivalents, exemptions and safeguard measures - Surveys/ Certificates	Continuous improvement of costumer protection has effect on competitiveness because it presses service and equipment providers to incorporate operations security in their product design, manufacturing technologies, materials used, logistics channels and service provision regimes so that the systems are more safer than, those in China and/or Indonesia. However, it is still uncertain whether the users in emerging markets will appreciate safety so high that they will be willing to pay much higher price for this functionality
Maritime	Directive on marine equipment (Equipment Safety Standards)	Directive 2010/68/EU	To make some amendments to marine equipment: - Life-saving appliances - Marine pollution prevention - Fire protection equipment - Navigation equipment - Radio-Communication equipment - Equipment required under COLREG 72 - Equipment under SOLAS Chapter II-1	Improving safety regulations improves protection of consumers and generates customer thrust and confidence which may strengthen the entire transport industry
Air	Civil aviation safety and accident investigations (Accidents)	Regulation (EU) No 996/2010	To improve efficiency, expediency and quality of European civil aviation safety investigations to improve the aviation safety in the EU, and provide assistance to air accident victims and their families as a permanent duty of the national civil aviation safety investigation authority in addition to elaboration of civil aviation accident emergency plan	Improving the safety regulations improves consumer protection and creates customer trust and confidence to which may strengthen the entire transport industry.
Air	Safety measures to prevent air accidents (Aviation Safety Management System)	COM (2011) 670 final	To ensure that the rate of air accidents continues to decline despite the continued growth in the number of flights and maintain the current low level of air fatalities by - introducing/improving safety management system - identifying safety hazards - carrying out safety data analysis - carrying out safety risk assessments - elaboration of the European Aviation Safety Plan	More stringent safety regulations improve customer protection and enhance consumer trust and confidence into air transport equipment manufacturers and airlines.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Air	Compliance of international safety standards on community airports (Inspections)	Directive 2008/49/EC	To improve air safety by ensuring that third-country aircrafts using community airports comply with international safety standards. It establishes a harmonised approach to effective enforcement of international safety standards in the Community by harmonising the rules and procedures for ramp inspections of third-country aircrafts landing at airports located in MS	A higher security standard protects customers in and around the airports. How this improves the competitive position of European aviation industry will depend who is the counterpart that competes for the same clients as the European airplane manufacturers and airlines do.
Road	Consumer protection (Passenger rights)	Regulation (EU) No 181/2011	To establish rules for the rights of passengers when travelling by bus and coach transport. It covers non-discrimination between passengers regarding transport conditions offered by carriers, rights of passengers in the event of accidents, non-discrimination and assistance for disabled persons and persons with reduced mobility, rights of passengers in case of cancellation or delay, minimum information to be provided to passengers, the handling of complaints and general rules for enforcement of - adequate assistance - guarantee of reimbursement or rerouting in situations of overbooking - compensation of 50 % of the ticket price following more than 120 minutes delay - information when the service is cancelled or delayed in departure - protection of passengers in case of death, injury, loss or damage - specific assistance free of charge for disabled persons and persons with reduced mobility - non-discrimination - complaint handling mechanism	The improvement of passenger rights should increase the attractiveness and therefore competitiveness of European operators.
Maritime	Consumer protection (Passenger rights)	Regulation (EU) No 1177/2010	To establish rules for passenger rights when travelling by sea and inland waterways. It introduces non-discrimination between passengers regarding transport conditions offered by carriers, and assistance for disabled persons and persons with reduced mobility, rights to information in case of cancellation or delay and handling of complaints according to the general rules of enforcement. - request compensation - rights of disabled persons and persons with reduced mobility - Rights in the event of interrupted travel - complaint handling mechanisms	The improvement of passenger rights should increase the attractiveness and competitiveness of sea and inland waterway operators. However, European inland waterway operators do not compete at international markets.
Reservation system	Consumer protection (Computer Reservation Systems)	Regulation (EC) No 80/2009	To establish harmonised code of conduct for use of computerised reservation systems in order to ensure the transparent terms of competition and to protect consumers' interests. - rules of conduct for transport providers - protection of personal data - infringements and penalties	The improvement of passenger rights should increase the attractiveness and competitiveness of maritime sector.
Road	Safety	Directive (EU) No 0062/2008	The directive seeks to improve the system for exchanging information between the MS and especially on infringements, violations and offences arising from speeding, driving with a blood alcohol level higher than allowed, non-use of seat belt as well as failures of stopping at red traffic lights. It	Reduction of accidents will increase transport quality and acceptance of the clients. Whether this will impact on competitiveness is, however, uncertain.

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
			aims at further reduction of the number of road accidents through better driving habits and stricter observation of the existing legislation.	
Air	Consumer protection	COM (EC) No. 99/2007	The consumer interests in different sectors should be more integrated. Air transport is separately mentioned with a goal to spread information on passenger rights from the aviation sector to other transport modes and especially, to passengers with reduced mobility.	Better coordination of policies will create less bureaucracy and facilitate the effectiveness of the industries daily operations. Whether this will increase competitiveness, remains however, unsure.
Rail	Rail passengers' rights	Directive (EC) No. 1371/2007	Supports the rail passengers' rights to travel information before and during the journey and compensation in case of delays, missed connections or cancellations as well as requirements for adequate personal security at stations and on board. A barrier free access and assistance to persons with reduced mobility or disabilities travelling by train should also be guaranteed by all MS. These measures aim at making rail transport more attractive and through that also more competitive. This might increase the share of rail transport in relation to road, air and maritime modes.	Support of rail travellers. Policy could create a better environment for rail transport and may increase the competitiveness of rail towards other modes. Whether this will translate into more sophisticated rail transport equipment which might be exported, remains, however, uncertain.
Maritime	Passengers' rights and safety measures in case of accidents	Directive (EC) No. 18/2009	Preventive measures enhancing maritime safety and reducing accidents. In case of an accident a thorough investigation is to be conducted and at the same time fair treatment and the rights of seafarers and passengers needs to be observed. A detailed investigation of accidents helps to understand the causes and prevent future incidents.	More stringent safety regulations improve protection of consumers and enhance consumers trust and confidence. This may increase demand and competitiveness of particular operators, but it is difficult to establish whether the positive impacts will spread to the entire industry.
Air		Regulation (EC) 1108/2009	Regulation on safety aspects of airport operations including air navigation services and Asynchronous Transfer Mode controlling the safety and passenger protection in the aviation (ATM) to improve data collection and transfer services and thereby improve the safety at airports.	More stringent safety regulations improve protection of consumers and enhance consumer trust and confidence.

Table 16: Summary of impacts of legislation related to working conditions

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
Air	Social job security and working conditions	Regulation (EC) No. 495/2012	Created rules for aircrew and cross-border workers aiming at better, simpler access to social security for air hostesses, stewards and pilots. The rules for air crew workers clarify the issues with cross-border activities and state that the social security legislation of the home base country, the country where the crew starts and ends their shift, applies to the employees instead of the country's legislation where the airline is based	Specification of social security rights for air crew-members in border-crossing traffic may increase operations costs in the short run. However, in the long run, more safe and secure workers may be more efficient and, thus, save the company some operations costs. Whether this happens is however, contingent on many other factors, such as the level of competition in a given industry.
Rail	Harmonization of driving requirements (Driving licence and certificates)	Directive 2007/59/EC & Commission Decision 2010/17/EC	Harmonization of train driving licences including safety management system training. Creates a register of valid certificates.	The provision supports competitiveness by making it easier for train drivers to move from one MS to another and from one railway to another while avoiding any distortion of competition. Ensuring a safety standard is a competition advantage. Costs of implementation and additional trainings as well as monitoring and control could affect competitiveness negatively.
Road	Harmonization of standards for road transport operators (Road transport operator)	Regulation (EC) No 1071/2009	Improve quality of road transport. Prevent skimping on safety and working conditions	Professional criteria for road hauliers using vehicles over 3.5 tonnes and commercial road passenger transport (> 8 seats) such as good reputation (ensuring ethical conduct), solid financial standing, professional competence (e.g. certificates) and stable establishment in a Member State are required. This should support competitiveness and prevent distortion of intra-EU competition.
Road	Driving times (International access)	Amending act: Regulation (EC) No 1073/2009	The Regulation aims to improve road safety and working conditions in the road transport sector.	The regulation limits driving time on carriage by road of goods (>3.5 tonnes) and passengers (>9 persons) in a sector subject to competitive pressures. The Regulation shall apply to all cross-border and international transport carried out exclusively within the territory of the EU, or between the EU, Switzerland and the countries party to the Agreement on the European Economic Area (EEA). Additional costs in the form of more driving personnel may cause disadvantages for competitiveness of larger road operators because the different classes of vehicles are not regulated similarly (<3.5tonnes). Although this regulation may reduce accidents and contribute to social benefits, it is quite uncertain whether it will improve the industry's global competitiveness.
Road	Motor vehicles and their trailers: roadworthiness test (Technical inspections)	(Directive 2009/40/EC) & Commission Recommendation 2010/379/EU	Harmonization of the technical monitoring to ensure road safety	As this directive aims at preventing distortion of intra-EU competition it should support competitiveness. By preventing accidents or and increasing other safety parameters, it definitely will produce some social benefits. Whether these will manifest themselves in bettering of competitive position of European manufactures of vehicle and road monitoring

Mode	Key issues addressed by the policy	Directives, regulations, decisions, communications, and white papers	Objectives targeted by the policy	Impact on the transport industry's competitiveness
				equipment is not clear.
Maritime	implementing the Maritime Labour Convention (MLC) (Maritime Social Package)	Council Directive 2009/13/EC	Improvement of the safety and social protection standards of maritime workers at workplaces including the limitation of maximum working times, definition of rest-periods and annual leaves and settlement of the requirements for medical certificates.	Higher safety and health standards bring along social benefits and strengthen the competitiveness of the European maritime industry because it improves the satisfaction and working performance of workers.
	Inspections and Monitoring (Maritime Social Package)	Proposal COM (2012) 134 concerning Flag State responsibilities for the enforcement of 2009/13/EC	Improvements in the safety and health of workers at work	The proposal requires monitoring mechanisms and inspections to ensure that ships are in compliance with the MLC requirements, as set out in Directive 2009/13/EC. Higher standards in Europe improve the European maritime industry competitive position if such standards are accepted and implemented globally. Uniform safety and health agreements strengthen competitiveness, protecting the market and its workers and also strengthen European performance compared to other markets.
	Port State Control (Maritime Social Package)	Proposal COM(2012) 129 amending Directive 2009/16/EC on port State control of MLC		MLC requirements should be integrated in Port State Control. This will include the Maritime Labour Certificate and Declaration of Maritime Labour Compliance in documents checked by the Port State inspectors, and investigation of complaints related to MLC matters. The same Regulation will pertain to all MS and recognised organisations that will apply the same document/certificate routines to better intra-EU cooperation and establish the equal level playing ground for all operators.
	(Maritime Social Package)	Directive 2012/35/EU amending Directive 2008/106/EC on the minimum level of training of seafarers (STCW)	Integration into EU law of the 2010 amendments to the STCW Convention	The entry into force of this Directive is quite recent. Thus an assessment of its impact is not possible, but it can be expected that better trained seafarers can performed tasks better, thus, bringing gains for the industry they worked in.
Maritime	Training for seafarers in the Community as regards training standards agreed at international level. (Maritime Social Package)	Directive 2008/106/EC	This directive defines a minimum level of training for seafarers. MS are responsible for: - Training - Certificates and endorsements - Penalties and disciplinary measures - Monitoring and evaluation of training - Rest periods for the watch keeping personnel - Dispensations from international rules	More demanding safety regulations increase protection of consumers and may enhance the trust and confidence of potential extra-European customers. When other technical and operational parameters are improved, this may strengthen global competitive position of European sea-going vessel building and maritime service provision industries.

9. Impacts of Energy Policy (ICTAF)

"...the transition from coal, oil, and gas to wind, solar, and geothermal energy is well under way. In the old economy, energy was produced by burning something — oil, coal, or natural gas — leading to the carbon emissions that have come to define our economy. The new energy economy harnesses the energy in wind, the energy coming from the sun, and heat from within the earth itself."
(Brown 2009)

Our standards of living require huge amounts of energy and that obviously generates pollution, whose impact needs to be reduced as far as possible. The EU is the world's second largest economy and consumes one fifth of the world's energy. Unfortunately, Europe has very few energy reserves of its own. This fact forces Europe to depend on the rest of the world for its energy consumption.

Much concern about volatile and rising oil prices and about potentially very costly consequences of greenhouse gas emissions have generated public debates about the need to manage energy consumption through policy interventions. In most developed countries, there is a long standing tradition of public policies designed to improve energy efficiency through governmental policy measures. The instruments of energy policy may include legislation, international treaties, and incentives for investments.

9.1 Main energy related policies

The importance of energy for EU countries was recognized after WW2. Establishing The European Coal and Steel Community (ECSC) was first proposed at 1951 as a way to prevent a further war. When the ECSC was indeed established in 1952 one of its main goals was to control collectively the two commodities (coal and steel) which were essential for warfare and reconstruction. The importance of ECSC diminished over the years since oil became the most important energy source. Six years later, the European Atomic Energy Community was founded in 1958, with the purpose of creating a specialized market for nuclear power in Europe. Despite these beginnings, European integration in the field of energy didn’t develop smoothly.

The dramatic increase in world petroleum prices associated with the Arab oil embargo of October 1973 highlighted the need for a new strategy for energy policy. In 1974 the EC adopted a program that prioritized producing energy from as many different sources as possible, so that no group could hold the world to ransom over oil. Later, in 1995 and again in 2000 and in 2007, the EC defined 'An Energy Policy for the EU'. These efforts focused on liberalizing the energy market to promote competition, business transparency and security of supply, but had little success.
Introducing a mandatory and comprehensive European energy policy was only approved at the meeting of the informal European Council on 27 October 2005 at Hampton Court, UK. Since then, in anticipation of a more robust European common energy policy, progress in the energy sector in the EU level has developed apace.

In 2008 the European Commission proposed an Energy Security and Solidarity Action Plan consisting of five main points reduction of consumption of primary energy by 20% by 2020,

strengthening and re-casting relations with the energy supplying countries, improving Energy efficiency by achieving 20% savings in energy consumption by 2020, and making the best use of the European Union's indigenous energy resources (EC 2008/C781).

A developed internal energy market could stimulate fair and competitive energy prices and energy savings. However, the European internal energy market is still far from being single. There are some reasons for this (Glachant 2013). First of all opening up of national monopolies to network operators from other countries may trigger opposition. Second, no substantial technology breakthrough is yet available to reduce the costs of "green" energy alternatives, and thereby diminish demand for the fossils. Boosting investments, in particular in energy production from Renewable Energy Sources (RES) is required in Europe in order to reduce emissions, create new jobs, raise industrial production, stimulate competition, as well as other targets, such as security and safety of energy supply.

The EU is already a global leader in renewable energy technologies. In 2007, the EU imported 82% of its oil and 57% of its gas, which turned it into the world's leading importer of these fuels (AP 2007).

9.1.1 Formal Legislation

Transport is the sector with the highest final energy consumption and is likely to remain so without any significant policy changes. The increase in energy consumption in the transportation sector was largely driven by growth in passenger mobility, particularly by car use (figure 6 from environmental chapter/2006 World CO2 Emissions from Fossil Fuel Combustion).

Therefore, several policy measures were adopted to improve transport energy efficiency with special focus on passenger cars, airplanes, sea vessels, and generally all transport vehicles.

Regulation 443/2009 EC sets emission performance standards for new passenger cars registered in the EC, which constitutes a part of an integrated approach to reducing CO2 emissions from the light-duty vehicles while ensuring the proper functioning of the internal market.

Directive 2009/33/EC requires that when purchasing cars, the contracting authorities, contracting entities as well as certain operators take into account the lifetime energy and environmental impacts, including energy consumption and emissions of CO2 and other pollutants. The aims is to promote and stimulate development of market for clean and energy-efficient vehicles and increase the transport sector's positive contribution to the environment, climate and energy policies' objectives.

Directive 1994/94/EC encourages uptake of cleaner vehicles by labelling European vehicles. The majority of labelling policies are aimed at passenger cars. There are 34 transport-related labelling policies in the MURE database, 80% are related to new vehicles and 70% are aimed at cars or passenger vehicles. The EU vehicle-labelling Directive for new passenger cars requires that:

- information on fuel economy and CO2 emissions is shown on a label displayed at the point of sale;
- a guide on fuel economy and CO2 emissions should be available at the point of sale verified by designated bodies;
- a poster (or a display) showing data on official fuel consumption and CO2 emissions of all new passenger car models should be displayed when vehicles are offered for sale or lease, or through, the respective points of sale;
- all promotional literature must contain the official fuel consumption and specific CO2 emission data for the passenger car models to which it refers.

Directive 2003/30/EC promotes bio fuels and other renewable energy sources for transport. The document stipulates that several national measures must be taken by the EU countries to replace 5.75% of all transport fossil fuels (petrol and diesel) with biofuels by 2010. The renewable energy progress report indicates that the EU reached an overall renewable energy share of 10.3% in 2008 (EC 2011/C31). However, the document mentions that the European members efforts mobilized to achieve these targets are still quite limited .

Another renewable **Directive 2009/28/EC** requires member states to produce a pre-agreed proportion of energy from renewable sources so that the EU total energy consumption from renewables reaches at least 20% by 2020.

Regulation (EC) No. 663/2009 on European energy programme to aid economic recovery (EP & Council 2009/663) establishes sub-programs to advance those objectives through bettering of:

- "Gas and electricity infrastructures – any equipment or installations essential for infrastructure (high-voltage, high-pressure gas pipelines, underground storage facilities connected to high pressure gas pipelines and facilities for reception, storage and re-gasification liquefied natural gas) should operate properly, including protection, monitoring and control systems.
- Offshore wind energy – generate electric power by turbines powered by wind and situated in the sea, whether near or far from the shore.
- Carbon capture and storage - capture of carbon dioxide (CO2) from industrial installations, its transport to a storage site and its injection into suitable underground geological formation for permanent storage."

This Regulation identifies projects to be financed under each sub-program and defines criteria for identifying and implementing actions to realize these projects. These projects aim to improve the European energy security and reduce greenhouse emissions. In order to meet those objectives the EC focussed on projects which may reduce the running cost for companies and increase competition. In addition, these measures may save the industry from additional large new investments in green technology.

9.1.2 Informal legislation, research and joint initiatives

The first occasion for a showdown between oil producer countries and consumer countries came with oil embargo imposed by oil exporters from the Middle East in October, 1973. During the months following this embargo, the EU member states experienced shortage of oil, which led to a number of measures to restrict consumption. As shortage fears diminished, prices and their financial consequences became the uppermost concern. Aside from these economic consequences, the 1973 crisis created a sense of insecurity among the European countries, and rightly so, for it revealed the vulnerability of their economies caused by dependence on oil imports and, specifically, on oil prices (Europedia n.d.).

In 1995 the European Commission published a White Paper that provided a convincing case for community energy policy, but also identified some limits to community action in this area (EC 1995/C682). This white paper presents policy guidelines which cover competitiveness, environmental protection, security of supply, external energy relations, promotion of energy efficiency, and renewable energy. It was endorsed by the Member States, and as a result the Commission adopted a Council Decision establishing a framework for cooperation between the EC and Member States to achieve the common energy objectives.

In 1997 the European Commission published another white paper, which focused on renewable energy sources. This paper (EC 1997/C599):

- Set out a Community Strategy and an Action Plan - including internal market measures, which reinforced Community policies, launched support measures, and a campaign for the take-off of renewables and improved co-ordination between the member states to double the share of renewable energy from 6% to 12 % in the Gross Inland Production by 2010.
- Established sub-targets in the various sectors.
- Preserved flexibility in the view of community enlargement.
- Instigated a tri-annual review procedure.

However, efforts to liberalize energy market, promote competition, business transparency, and security of energy supply attained little success.

As noted, the Treaty of Lisbon of 2007 provided the legal basis for solidarity in energy supply and changes in the EU energy policy. Prior to the Treaty of Lisbon, EU energy legislation was based on the EU authority in the area of common market and environment. Yet in practice many energy policy competencies remained at national levels, and progress in policy at the EU level required voluntary cooperation between the Member States (Braun 2011). The Lisbon Treaty sought thus to simplify the institutional structure and decision making process to boost efficiency, coherence, and democratic legitimacy by involving citizens and institutions representing them, and increasing its own competencies in areas of citizens' concern. The changes brought by the Lisbon Treaty required quite many actions and measures to be taken in the near future. One of the main changes was the establishment of the European External Action Services which was to coordinate the member states actions outside the Union (Takman 2013). This organization provided the different EU institutions with power to influence international politics and thereby, also the competition between the

different energy policy sub-sectors.

COM/2010/0639 outlines a strategy for competitive, sustainable and secure energy availability (EC 2010/C639) and sets out the European Commission's energy strategy for the period up to 2020. The strategy is structured around 5 priorities:

- Reducing the energy use in Europe.
- Building a pan-European integrated energy market.
- Empowering consumers and improving energy safety and security.
- Extending Europe's leadership in the development of energy technology and eco-innovation.
- Strengthening the external dimension of the EU energy market.

National overall targets	2005 Share	2020 Target
Belgium	2,2 %	13 %
Bulgaria	9,4 %	16 %
Czech Republic	6,1 %	13 %
Denmark	17,0 %	30 %
Germany	5,8 %	18 %
Estonia	18,0 %	25 %
Ireland	3,1 %	16 %
Greece	6,9 %	18 %
Spain	8,7 %	20 %
France	10,3 %	23 %
Italy	5,2 %	17 %
Cyprus	2,9 %	13 %
Latvia	32,6 %	40 %
Lithuania	15,0 %	23 %
Luxembourg	0,9 %	11 %
Hungary	4,3 %	13 %
Malta	0,0 %	10 %
Netherlands	2,4 %	14 %
Austria	23,3 %	34 %
Poland	7,2 %	15 %
Portugal	20,5 %	31 %
Romania	17,8 %	24 %
Slovenia	16,0%	25 %
Slovak Republic	6,7 %	14 %
Finland	28,5 %	38 %
Sweden	39,8 %	49 %
United Kingdom	1,3 %	15 %

Figure 13: National overall targets for the share of energy from renewable sources in gross final consumption of energy in 2020 (Sturc 2012)

To support the objectives pursued by binding legislation - mainly those targeted at improving energy efficiency, energy diversification and promotion of renewables - the European Union launched in 2003 the Intelligent Energy-Europe (IEE) programme. This programme shall encourage energy sustainability in a wide range of areas, including transport, in a push to reach the EU 2020 targets (20% cut in greenhouse gas emissions, 20% improvement in energy efficiency and 20% of renewables in EU energy consumption). IEE budget was of €730 million from 2003 till 2013. 16% of the allocated funding employed between 2007 and 2012 was dedicated to transport projects. The projects under the STEER pillar of the IEE programme had the following objectives 1) to develop an energy-efficient transport which optimises the use of vehicles, 2) to improve logistics and influence the driving styles and mobility attitudes, and promote a modal shift, 3) to facilitate the market uptake of clean and energy-efficient vehicles, and 4) to promote capacity building and learning. The funds allocated to transport project contributed to

- An increase in the use of more sustainable transport modes such as cycling, public transport and car sharing. The outcomes produced encompasses energy savings which reached 20 000 toe/year from enhanced magnitude of cycling and 2 million litres from usage of less fuel-consuming transport
- Stimulation of favourable legal and market conditions for alternative fuels (biodiesel filling stations, awareness campaigns)
- Inclusion of energy and environmental requirements into public procurement by selected cities
- Enhanced access to information on European policy and its instruments

The relevance of this programme for the European transport industry is summarized in the table at the end of this chapter (EC 2013 d).

There are several Technology Platforms relating to energy that may impact the competitiveness of the transport industry in Europe:

- The European Biofuel Technology Platform (EBTP) was set to contribute to the development of cost-competitive biofuels and to accelerate sustainable deployment of biofuels in the EU through R&D and demonstration. The EBTP research contributes to several directives, such as the Fuel Quality Directive, and the Renewable Energy Directives (European Biofuels Technology Platform n.d.).
- The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) is a public private partnership supporting R&D and demonstrations in fuel cell and hydrogen energy technologies in Europe. Hydrogen is a clean and efficient energy source which is suitable in combination with fuel cells for future transport applications, and both technologies were identified among new energy technologies needed to achieve 60%-80% reduction in greenhouse gasses by 2050 (Fuel Cells and Hydrogen Joint Undertaking n.d.).
- The Photovoltaic Technology Platform aims to become a point of reference for decision makers on strategy and implementation of photovoltaic solar energy reaearch in the EU (Photo Voltaic Technology Platform n.d.).

- Zero Emission Fossil Fuel Power Plants (ZEP) promotes the use of CO2 Capture and Storage (CCS) as key technology to combat climate change and make it commercially viable by 2020 through R&D acceleration in the EU (Zero Emissions Platform n.d.).

9.2 Assessment of Impacts on European Transport Industry

Energy policy is intrinsically tied to climate change, external vulnerability of hydrocarbons imports, the promotion of growth and creating new jobs, and the provision of secure affordable energy to consumers, manufacturing and service industries (including transport industry) which serve the EU and the extra-EU markets. Also, energy policy is essential for meeting challenges such as:

- Competitiveness: a competitive internal energy market will reduce energy costs for citizens and companies, and will stimulate investments in clean technologies and clean production facilities, including in the transport sectors.
- Sustainability: a competitive internal energy market is vital for the effectiveness of environment protection instruments such as emissions trading mechanism and proliferation of clean-energy innovations.
- Security of supply: an effective and competitive internal energy market can improve security of energy supply and eco-standards of European transport industry.

Assessing impacts of the different energy policy instruments on competitiveness of European transportation industry is a complex task because this policy affects the different sectors and sub-sectors in various ways at the same time, interacts with the other policies measures and their outcomes (such the industry competiveness and social harmonisation legislations), and also are affected by industry-mobilised energy-oriented strategies, measures and initiatives.
Transportation is the major consumer of oil. As a result, transportation industry is also a major generator of greenhouse gases. However, mmeasures to decrease oil consumptions and CO2 emissions in transportation are almost always seen separately from energy sector (Litman 2005) despite the fact that European energy and transport sectors are facing two very similar challenges today. Both the European transport and the energy industries seek to decrease oil consumption. Yet, no politically acceptable strategies have so far been devised to achieve this goal. One possibility would be to proliferate the usage of electric vehicles and/or hydrogen-powered vehicles in order to replace petrol and/or gas-driven transport. Another entails increasing the supplies of sustainable energy from renewable sources such as hydroelectricity, solar energy, wind energy, wave power, geothermal energy, artificial photosynthesis, and tidal power. Such renewable technologies may gradually replace the demand for oil and gas, and reduce the European dependence on fuel imports. The above shows that impacts of the EU energy policy might be closely related to the impacts sought by environmental and social protection legislations. With regards to the transportation sector both policies focus on air quality, climate change, noise and waste reduction, and to some extent, on resource efficiency. Also, both policies promote the growth of renewable energy sources which affects economy as a whole, but also the business environment of industry and social health. However, as the proliferation of renewable energy sources varies between the economic agents in different sectors, including also transport industry, their impacts on transport's competitiveness also vary within EU. As energy sources, prices and energy consumption vary between the member

states, so do the impacts they generate on energy security, economic efficiency, GDP and industrial employment. In this context, some economic implications (Ragwitz 2009) for the European transportation industry are listed below:

- Changes in demand for investments which underpin productivity, on which the European transport's employment depend on may affect this industry's ability to modernize its production base and reduce manufacturing costs if its managers exceed the gains achieved by direct contenders in markets they compete for.
- Changes in households' environmental awareness regarding energy consumption by private cars may reorient the purchasing behavior towards more environmentally sustainable vehicles, and increase the demand for more fuel-efficient and less polluting transport.
- New investments in manufacturing and energy-saving technologies may increase productivity and reduce labor costs in a given unit of economic output thus increasing the cost competitiveness of the transport industry.
- New technologies in automotive component producing sectors, infrastructure and manufacturers of auxiliary equipment (such as ICT systems and hardware) may enhance the European transport industry competitiveness provided that the European innovators recoup the new technology costs quicker than their rivals in the same and/or complementary industries.
- Changes in export and import trade for fuels combined with European growth in alternative vehicle-powering technologies may make off-shoring of production and/or assembling transport operations economically less feasible for corporate decision-makers.

These effects may change the present structure of the European transport industry, its competitiveness compared to external rivals, and its ability to retain and/or extend market presence in European and global settings. The rising consumer awareness of importance of alternative fuels and more advanced technologies for cleaner transportation may support the governmental policies which promote energy efficiency and low-carbon industrial investments. In order to meet these market needs, European transport companies may have to increase their R&D investments in eco-improving innovations, more environmentally sustainable vehicles, infrastructures, and more advanced electronic traffic management systems and equipment. Companies that will not participate in the transport greening process will not succeed in this race, and might lose market shares and competitive edge. But those who will succeed along this line may win new market positions in EU and globally. As a result, a wide-ranged restructuring of European transport industry towards more-environmentally friendly vehicle manufacturing and service provision may take place in the forthcoming years.

Table 17: Summary of impacts of energy related legislation, programmes and ETPs

Key issues addressed by the policy acts	Directives, regulations, decisions, communications, and white papers	Policy objectives	Impacts on transport industry's competitiveness
Energy 2020, Strategy for competitive, sustainable and secure energy	COM (2010) 639 final	Lower energy use in Europe; Building a pan-European integrated energy market; Empowered consumers and improved vehicle safety and security; Europe's leadership in energy technology innovation; Influence over external dimension affecting the EU energy market.	All these regulations are likely to have positive effects on private investments in R&D, also on transport sector. As a result, transport companies may increase their investment in R&D in order to meet the new energy efficiency standards. Those regulations put EU at the top of the world's energy efficiency demands. If implemented this legislation may propel the European transport sector to acquire competitive advantage over other countries' automotive sectors.
Set emission performance standards	Regulation 443/2009 EC	Efficient functioning of internal market and introduction in European Community of 120 g CO2/km as average emissions threshold for new cars.	
Promote clean and energy-efficient road transport vehicles	Directive 2009/33/EC	Bigger market for clean and energy-efficient vehicles, reduction of transport impact on environment, climate and energy policies by requiring that customers take into account the lifetime energy and environmental impacts, including energy consumption and emissions of CO2 and other pollutants, when purchasing vehicles.	
Vehicle labelling	Directive 1994/94/EC	Informing the consumers on car fuel economy to affect the vehicle purchases.	
Promote the use of biofuels or other renewable fuels for transport	Directive 2003/30/EC	Promotion of bio-fuels and/or other renewable energy sources to replace diesel or petrol for transport purposes. Fulfilment of climate commitments, higher environmentally friendly security of supply and usage of renewable energy sources.	
Programs to aid economic recovery by granting Community financial assistance to projects in the field of energy	Regulation (EC) No. 663/2009	Establishment of financing instrument entitled the European Energy Programmed for Recovery (the EEPR) to support projects in the field of energy which shall contribute to economic recovery, the security of energy supply and reduce the greenhouse gas emissions.	
Provide financial assistance to projects in the field of energy	Regulation (EU) No. 510/2011	This Regulation establishes performance requirements for carbon dioxide (CO2) emissions from new light commercial vehicles	Likely to have positive impact on the investment in low emission cars, this regulation places European car manufacturers at a higher level of environmental friendliness in the eyes of consumers. As a result, the European transport sector may have a competitive advantage over other countries.

Key issues addressed by the policy acts	Directives, regulations, decisions, communications, and white papers	Policy objectives	Impacts on transport industry's competitiveness
Promote the use of biofuels or other renewable fuels for transport	Directive 2009/28/EC	To increase the share of energy from renewable sources in the gross final consumption of MS up to 2020. More specifically the target for the transport sector is to increase the share of energy from renewable resources to at least 10 % of final energy consumption within 2020. Further objectives of the Directive are reducing GHG emissions, encourage energy efficiency, improve the energy supply and economically stimulate the energy sector.	By promoting the use of renewable sources within the transport sector, this policy may equip the transport industry with a competitive advantage in a future where it may be necessary to use alternative sources of energy because traditional ones are either inadequate or too expensive or simply unsustainable. Technological development can be expanded to other industries creating favourable conditions for the increase of trade and transport of goods.
Energy Security and Solidarity Action Plan	COM (2008) 781 final	The goal of this non-binding policy document is to reduce energy consumption and energy imports (by almost 15 % and 26 %, respectively) by 2020 by means of developing the required infrastructure, diversification of energy supply (for which external relations are key), increasing energy efficiency and optimizing the use of European energy resources. At aiming those goals the greening of transport shall perform an important role.	On the one side, diversification of energy supply (including increased shares of European produced energy) may generally reduce the vulnerability of European industries (including the manufacturing and service provision transport industry) due to dependency and possibly political instability from and in external suppliers of energy. On the other hand increases in energy efficiency may reduce operating costs and push up technological development and industrial uptake of solutions to make a more efficient use of energy.
Energy Policy Action Plan	COM (2007) 1 final	Introduces a series of measures regarding European energy policy that enable to cope with the energy challenges with regards to sustainability, energy supply security and energy efficiency by means of establishing an integrated competitive energy market, ensuring energy supply and reducing GHG emissions (either by developing new technologies or increasing the share of renewable energy), or considering to apply a common and coherent approach with regards to nuclear energy.	Depending on how the plans and measures proposed are implemented, the transport industry will need to adapt to them.
Energy programme	Intelligent Energy – Europe (IEE) Programme	Create the necessary conditions for a more sustainable energy future by means of improving energy efficiency, diversifying energy sources and promoting the use of renewables in several fields which also include transportation	The outcomes of the programme described above can improve the market uptake of innovative transport solutions, including cleaner and more efficient vehicles. Thus, manufacturers may need to adjust to this new demand. However the programme's influence is limited to Europe, so manufacturers that want to compete in global markets may need to develop multiple lines of products to satisfy that global demand, which may evolve apace to that in Europe.
Support energy related R&D infrastructure	The European Biofuel Technology Platform	Development of cost-competitive biofuels and to accelerate sustainable deployment of biofuels in the EU through R&D and demonstration.	The Technology Platforms may have a positive impact on transport industry competitiveness since they provide a unique source of knowhow for the industry, especially when competing industries has no access to similar platforms in their own countries.
Support energy related R&D infrastructure	The Fuel Cells and Hydrogen JU	Public private partnership supporting R&D and demonstrations in fuel cell and hydrogen energy technologies in Europe	
Support energy related R&D infrastructure	The Photovoltaic Technology Platform	Point of reference for decision makers on strategy and implementation of photovoltaic solar energy research in the EU	
Support energy related R&D infrastructure	Zero Emission Fossil Fuel Power Plants	Promotes the use of CO_2 Capture and Storage (CCS) as key technology to combat climate change and make it commercially viable by 2020 through R&D acceleration in the EU	

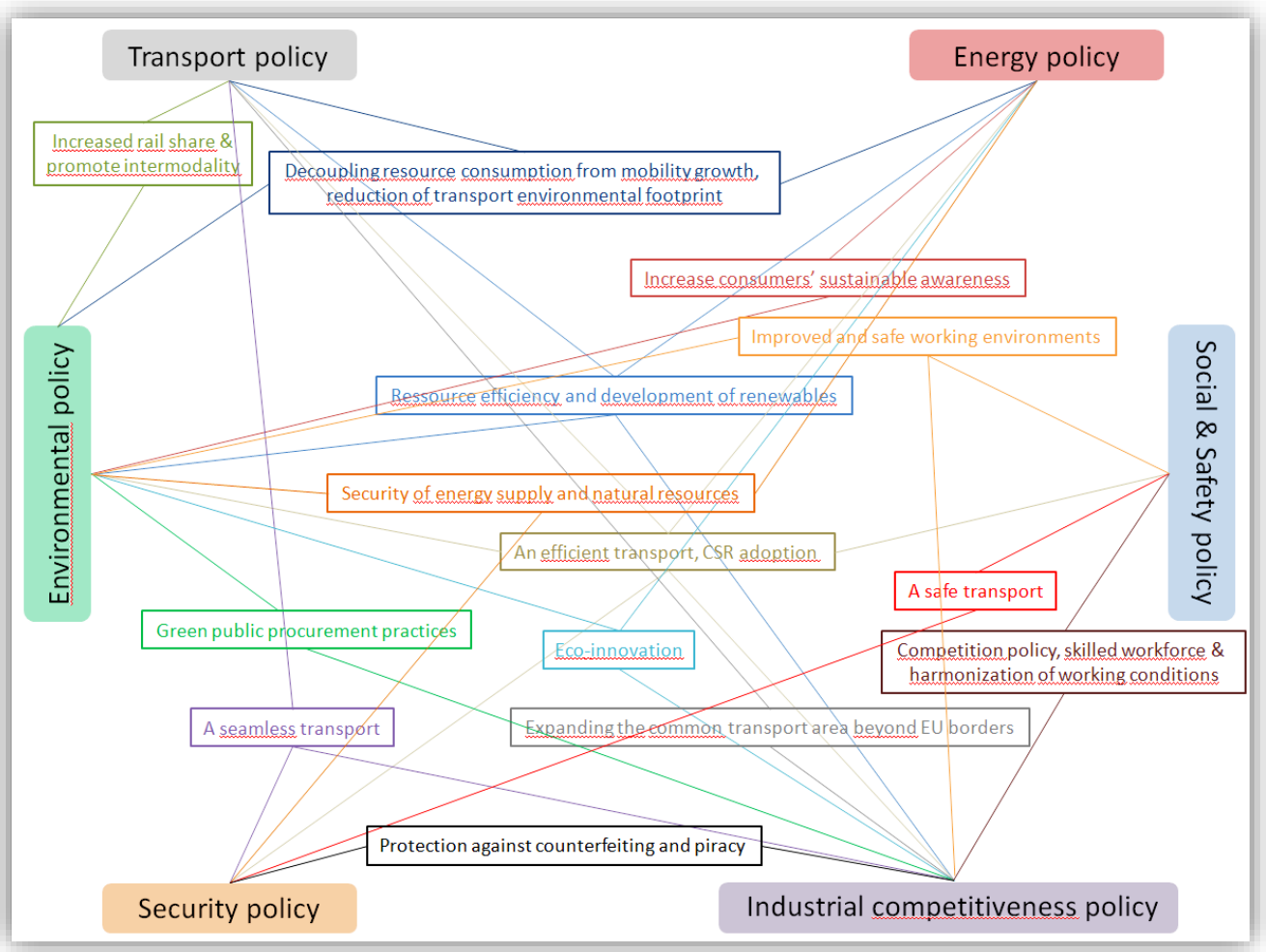
10. Synthesis of results (TØI)

Using the analytical model presented in D3.7 introduction we synthesize in the following the policy impacts assessments in the previous chapters.

10.1 Main policy objectives

The main policy objectives pursued by the different policy areas are presented in a figure below. The graphics indicate that certain policy objectives cannot always been reached through launching one single policy measures. Since most of the objectives have implications for several different classes of stakeholders, they require coordination to assure implementation and goal attainment.

Figure 14: Interconnections between the different policy areas for attainment of policy objectives



Therefore, several policy objectives are also targeted by the European Technology Platforms (ETP) and Joint Technology Undertakings (JTU). Although they are specifically tailored for a given policy area, the ETPs and JTUs aim precisely at integrating different interests and, therefore pursue the

objectives which are common for all policy areas, regardless of the specific fields. These include

- Formulations of Strategic Research Agendas and roadmaps for their implementation which together provide long-term visions for research and development of technologies needed,
- Strengthening of EU cooperation through coordination of European, national, regional public and private R & D activities and clustering the European R&D capabilities,
- Promotion of European research and technology developments
- Stimulation of public-private investments,
- Overcoming of challenges and barriers in order to facilitate policy implementation and application of research outcomes in the markets
- Maintaining European leadership and / or strengthening of European industry capability to compete in global markets

10.1.1 Transport policy

Certain transport policy objectives cover all transport modes. These include

1) Development of the TEN-T network to provide the transport industry - but also other industries - with single, efficient, seamless, sustainable single multimodal network,
2) Promotion of IWW and rail to make intermodal transport more sustainable, and
3) Integration of neighbouring countries into the European common transport policy in order to expand the European transport network beyond its borders, ensuring its seamlessness.

The common transport policy also aims at better integration of demand and supply of transport products and services and facilitation of systemic changes through R&D. Most of these objectives are pursued through informal policies because they require cooperation and integration of interests across the different modes and MS. The European transport binding legislation is divided into transport modes – rail, road, waterborne and air – for which the policy objectives are summarized below.

Rail

Main objectives of the formal rail policy include harmonization of technical standards of rail systems (both conventional and HSR), development of the necessary infrastructure, higher standards for safety and accessibility for disable people, enhanced interoperability and integration of MS' rail networks, in which ERTMS has to play an important role, higher efficiency of rail freight transport by improving coordination between the MS, establishment of common rules for management and operations of trans EU-corridors, increase of railways capacity, and, creation of an EU wide authorization and certification rail system.

All the above objectives shall contribute to three political goals

1. Attainment of seamless transport on railways
2. Increase in the share of rail transportation in both passenger and freight carriage
3. Higher competitiveness of the European rail transport industry

Informal policy shall speed up the pace of innovation, secure long-term financing, identify synergies between the different research activities and stimulate the private-public, the national and the European research undertakings.

Road

The main objectives of road transport policy include reduction of the inter-MS differences between with regards internalization of the external costs of heavy duty vehicles, monitoring of internalisation of external costs generated by light vehicles to avoid discrimination, and facilitating access to international carriage of goods, passengers and services for non-resident road transport operators (both for passenger and freight). These objectives shall ultimately

1. Ensure that road transport truly reflects its external costs (through appliance of the user-polluter principle)
2. Avoid discrimination
1. Reduce environmental footprint of road transportation (through, e,g. reduction of empty runs)

Informal policy is adopted to support those objectives, by monitoring the areas out of scope of the EU legislation such as the road infrastructure charges for light vehicles and supporting research projects that focus on hybridisation and electrification of road transport, new fuel technologies, establishment of sustainable and efficient freight corridors, and integrated mobility systems.

Waterborne

The waterborne transport policy consists of two sectors. The first encompasses the formal policy supporting river information services (RIS), the technical harmonization of vessels, and promoting the compatibility and interoperability with other modes shall contribute to the promotion of inland waterways (IWW).The second pertains to promotion of maritime transport through simplification and harmonization of administrative procedures and reporting formalities, and introduction of a standard electronic transmission in addition of providing financial resources to development of an Integrated Maritime Policy

The policy promoting water-born transport aims at

1. Reducing overland congestion and environmental footprint of transport;
2. Creation of common EU and worldwide standards for maritime transport
3. Utilizing the European short sea shipping's competitive advantage and optimizing the inland navigation

However, as maritime transport is mainly a global service (apart from S SS) a great deal of skills is needed to promote dialogue between the relevant stakeholders, to facilitate access to research and innovation facilities and cooperation on international standards. Informal waterborne policy, in cooperation with other policy areas (safety and environment) also contributes to attracting skilled workforce, improving shipping service quality, safety and security and the sector's environmental performance.

Air

The objectives of air transport policy involve

1) facilitation of equal market access for air service providers through simplification of access rules, increasing competition between air service providers but at the same time, avoiding discrimination

and conflicts, 2) improving slot allocation and safety levels (to minimum standards) and functioning of the European aviation market through provision of common technical requirements and administrative procedures, 3) increasing capacity and cost-efficiency of air services through improved communication between the actors involved in provision of such services (pilots, airports, traffic controllers) and the quality (and quantity) of information interchanged, and modernization of the European ATM system, and 4) reducing delays and protecting users of air services. Some of these objectives are also shared by the consumer and environmental protection policies

The achievement of these objectives shall
Modernize the sector by making it to adapt to modern technologies and other challenges such as environmental and safety/security concerns by decoupling air traffic growth from safety incidents and environmental footprint; and
Liberalise the air market while safeguarding the quality of services and customer protection

10.1.2 Environmental policy

The main goals for environmental policy, as compared to transport, involve improvement of air quality, reduction of GHG emissions, noise and waste from dismantling vessels and vehicles and higher resource and energy efficiency. Attainment of these goals shall mitigate climate change, at least that portion which is related to transportation. Both the formal and informal legislation pursue these overarching socio-environmental goals.

The policy objectives to increase the air quality also include reduction of GHG emissions. While the energy policy targets lowering of GHG from the perspective of energy efficiency, the environmental policy does it through application of users and polluters principles. For instance, at individual level, it promotes selection of more sustainable transport modes and/or purchase of energy efficient and cleaner vehicles through taxation which will increase the consumer awareness and influence purchasing behaviour. This shall ultimately encourage production of less polluting vehicles and the provision of environmentally friendlier transport services. At industrial level, the atmospheric pollution shall be reduced through incorporation of transport services into the European Emission Trading Scheme (ETS). But, the objectives alone are not enough to produce the expected results. Therefore, better monitoring and reporting of GHG emissions through t development of new mechanisms shall foster attainment of environmental policy goals.

Minimising waste from the end-of-life vehicles by promoting e reuse, recycling and recovery of their components and reduction of hazardous substances in manufacturing of vehicles and vessels shall further encourage the manufacturers to produce more greener products.

Avoid, prevent or reduce the negative effects of environmental noise is most important for the air transport with binding legislation applying to airports. In the maritime transport, the protection of the marine environment from ships pollution is to be enhanced by penalties.

Closely related to energy policy is promotion of energy-efficient road transport vehicles, reduction of road transport and promotion of inter-modality to increase the shares of railways and IWW.

However, the development clean vehicle and vessels technologies, and innovative and competitive transport services requires well-crafted policy framework for private/public research partnerships. This is especially true in the aviation sector (through Clean Sky Joint Technology Initiative and SESAR) due to the high amounts of required financial investment.

Informal legislation within the field of environmental policy facilitates these objectives through involvement of multiple stakeholders for promotion of inter-modality. Revitalising of railways, inland waterways and sea transport can make transportation more sustainable but also affect the goods and passenger volumes moved by air and road. So, the policy targeting those goals cannot be developed without considering all industries. Although reduction of fuel consumption may contribute to environmental policy goals it may also require tighter collaboration between the energy sector and the transport industry in addition to more funding for research. And, not less important, the environmental policy goals should also be approached from a global perspective, which requires signing of international or multilateral agreements. Examples for the later are the incorporation of aviation into ETS or ship breaking. Ensuring that the EU ships are disassembled at safe and environmentally responsible locations worldwide requires a lot of international cooperation.

The voluntary collaborative initiatives support technologies improving operational procedures of air transport, reduction of GHG emissions, noise from rail freight trains and noise exposure of European citizens to motor vehicles without jeopardising safety of other road users. They contribute to sustainable urban mobility. Research also contributes to CHG mitigation, and assessment of benefits of environmental footprint reduction. Improved monitoring and development of new indicators may speed up internalisation of external costs of transport.

10.1.3 Security policy

The security policy seeks to safeguard people, industrial installations and societal functioning frm man-made and natural disasters. With regards to transport this goal translates into prevention of incidents that may harm people, goods and/or transport infrastructure through deterring, detection, deny and mitigation. The policy prevents first of all the loss of human life, and direct and indirect costs arising from theft, displacement and/or harms to goods, or disruption of logistics services and supply chains. It also provides activities and measures needed to counteract the security incidents.

The security legislation for air transport and aviation has many binding objectives. First, by providing common security framework through harmonized aviation security and quality control programs, designation of single responsible authority in each MS, and putting obligation on each airport and carrier to draw up a security program, it aims at preventing the acts of unlawful interference against civil aviation. Second, it provides a room to derogate from the common basic standards on civil aviation security and adopt alternative security measures which are most relevant for a given MS. Third, it aims to improve the passengers' trust in security of air transportation. And, fourth, it monitors effectiveness, implementation and compliance with security measures though specially designed monitoring procedures.

With regards to maritime sector, the EU security legislation incorporates international rules

resulting from cooperation efforts against the threats to global maritime security within the EU territory. Furthermore, the EU maritime security legislation also seeks to raise the level of security through facilitating of homogeneous interpretation of rules, and creation of comparable level of security at all EU ports, and generally, reduction of probability of security incidents through prevention, detection, response and recovery.

Rail security legislation encompasses regulation of interoperability at cross-borders and customs procedures. As regards road transport, no specific binding security legislation exists at the EU level. However, it does pertain to general transport, and specifically, to security of shipments entering or leaving the internal market. The legislation specifies the responsible agents, deadlines and places to lodge the entry summary for goods carried by each transport mode.

As regards informal policy, the main security objectives cover four objectives, deter, detect, deny and mitigate. They also include the development of high security systems, improved access to emergency installations, facilitation of cross-border procedures and customs, and adaptations to evolving security threats of natural, social and criminal character.

10.1.4 Industrial competitiveness policy

The objectives of this policy are probably the most multifaceted because industrial competitiveness policy as such does not exist. Yet, it encompasses a blend of several legislations with high relevance for enhancing (or hampering) competitiveness of transport industry.

Competition policy generally ensures that national subsidies or measures allotted to companies restructurings (to enhance the specific industries' performance through provision of financial support, allowance of certain business practices and merger exemptions) do not harm the competitive environment but encourage sustainable long-term investments, standardization of technical equipment, optimization of the existing transport infrastructure and improvements of operational performance.

Provision of financial support could also be pursued by economic and financial policy instruments such as the bond initiative or the Risk Sharing Financial Facility (RSFF), but requires that resource utilization is optimized and renders maximum impacts.

The main goal of research and innovation policy is to turn innovation into an overarching goal of any policy, regardless the area addressed, and contribute to development of market-ready products and services through identification of KET, creation of JTI (to increase the scale of impact on competitiveness) and support to ETPs (with all objectives that the ETPs usually pursued).

The main policies on internal market which also are relevant for competitiveness of the transport industry are those which rule the EU public procurement and Community trademarks. The recent public procurement legislation aims to facilitate cross-border public procurement, reduce the administrative burden and include environmental, social and innovation aspects, but also to protect the Community trademarks.

The external trade policy is very relevant for the European transport industry in order to counteract the monopolies, subsidies and dumping practices of third countries which harm the industry, but also to facilitate new business opportunities in external markets for European companies.

Besides, several other informal policies either complement the binding legislation or have targets of their own. Their goals and objectives include stabilization of financial markets, facilitation of investments in innovation, improvement of business capacity, (especially of SMEs) to access new markets, develop human skills (partly through promotion of PPP), promote entrepreneurship, fighting of counterfeiting and piracy, identify and support for KET and EU legal harmonisation, access to natural resources and their sustainable consumption, and facilitate the adoption of CSR principles by business.

Although these objectives generally apply to all industries, the transport industry and the development of transport infrastructure are seen as key facilitators of improvement of business conditions and competitiveness. In fact, enhancing competitiveness of transport sector and especially that of the European global transport services is needed because transport is considered a major barrier to internalization by SMEs.

Furthermore, some of the policies target specifically the transport industry. As regards the motor industry, the policy seeks to foster demand for new more environmentally sustainable vehicles, retain car manufacturing in Europe, reduce the pollutant and noise emissions, and deploy new mobility solutions and alternative fuels.

Identification and harmonization of qualifications needed to upgrade the skills of professionals working in the maritime and shipbuilding sector and enhancement of workers mobility are the main maritime policy objectives aiming to make the waterborne sector more appealing and competitive (also by counteracting the high prices through provision of high-quality workforce and services).

The objectives of aeronautics sector encompass adherence of overseas aircraft manufacturers to fair trade conditions, improvement of market for intelligent aircrafts, vehicle safety and efficiency, and reliability of services, including the unmanned services.

Other objectives such as facilitation of access to financial resources and liquidity, support for research (including the simplification of public R & D programmes) and involvement of stakeholders, removal of trade restrictions and improvement of technical standardization, also in other industries. In addition, several objectives aim at other industries also relevant for transport. That is the case with space industry’s goal of securing technological non-dependence and independent access to space, and tourism industry where the objectives is to reduce seasonality and environmental impacts and increase of customer satisfaction.

Achievement of these objectives are further supported by ETPs and JTUs, which in addition to industrial competitiveness also aim at exploring of integration and use of innovative materials in manufacturing of transport vehicles. Also, improvement (almost transformation) of manufacturing

and assembling processes and technological base and adoption of innovative solutions in logistics, and management of supply chains represent more specific goals. Due to novelty of some of the technological fields (nano-materials, photonics, embedded intelligence and systems) the ETPs and JTUs play a key role in helping to understand and integrate these breakthroughs into established processes.

10.1.5 Social security and consumer-protection policy

Within this policy area two clearly differentiated though linked, policy fields exist: regulation of working conditions for professionals in transport industry and protection of rights and safety of transportation users. They are linked because they reinforce each other. A skilled workforce with proper training can increase the safety level and better meet the customers' needs, also when dealing with violation of their rights. Consequently higher safety level translates into better working conditions for transport professionals.

With regards the former, the main policy objectives include improvement of working conditions (including daily, weekly working hours and night shifts and inclusion of proper breaks and rest periods), creation of common standards for provision of uniform services and harmonization of training requirements, so that the amount of high-quality jobs can be increased in the European transport industry.

In addition, for each transport mode we find more or less specific policy goals. Social security policy targets better coordination and monitoring, and through that, better compliance with working regulations in maritime sector by all MS. By introducing higher standards for social protection, including on-board conditions for all seafarers on EU-flagged vessels and European seafarers on non-EU flagged vessels, and eco-protection against environmental pollution, the policy seeks to make the maritime transport much safer. In road transport, the focus is on improving the roadworthiness of commercial vehicles and quality requirements for driving licenses. In rail transport the goal is training of rail workers (also those at the stations) so that these are in position to better confront and deal with special incidents, and thereby secure safe rail journeys. In the aviation sector, the social security policy wants to improve working conditions for aircrew and cross-borders workers, especially unemployment benefits.

With regards to consumer protection, the policy targets creation of common safety standards for manufacturing of transport vehicles and vessels, service operations and maintenance of equipment. It also aims at improving data exchange systems in road, maritime and aviation sectors, more protection for users' rights in case of cancellations, delays, luggage losses, and facilitation of access to and free choice of transport modes by disabled people. The latter includes development of the necessary infrastructure, adaptation of vehicles, and provision of assistance. It looks like that aviation managed to meet the latter requirements far better than the other transport sectors.

Here again the specific policy objectives target specific transport modes. Maritime safety policy focuses on creation of common maritime space. However, the EU policy does not have sufficient judiciary power because it cannot regulate how to apply safety standards on the seas and in ports all over the world, and how to improve maritime surveillance so that sea incidents investigation are

carried out in a manner that allows to learn from failures and prevent recurrent failures. Furthermore, safety maritime policy stipulates the maximum speed limits for vessels and also specifications for navigational equipment.

One specific objective of rail safety policy is to strengthen the role of the European Railway Agency. The road transport policy initiatives aim at promotion of use of safety equipment and reduction of road accidents with special focus on motorists and road "vulnerable" users. As the EU aviation safety policy promotes identification of the different risks affecting safety of passengers and users through development of technology and information exchange (including investigation of accidents), its attainment requires a great dose of international cooperation.

10.1.6 Energy policy

The energy policy has evolved considerably during the last half of the twentieth century. The initial goals promoting competition, business transparency, liberalisation of energy market, diversification of resources and integration of European energy market has been broadened to also encompass the reduction of GHG emissions, development of renewable energy sources and higher energy efficiency. In order to develop a unified position in talks with the extra EU energy supplying countries, this required strengthening of the intra EU relationships and development of necessary infrastructure. Better exploitation of indigenous energy resources has also become more important for diversifying the energy sources.

Linking of energy policy objectives to transport, which represents a highly energy dependent industry, was done by decoupling energy consumption from the growth in mobility demand. Achievement of these policy objectives was to be enacted by adoption of several binding and non-binding legislations. They pertain to improvement of transport energy efficiency, especially in vehicles, reduction of GHG emissions from the entire transport sector and particularly, CO_2 from light duty vehicles, and development of market for clean and energy-efficient vehicles. The latter was to be attained through the EU co-funded research, supporting programmes, public procurement, labeling schemes, increase of public awareness on sustainability, and consumer empowerment. Promotion of bio-fuels and other renewable sources in transport was also mentioned as another measure of policy implementation. In addition, provision of new collaborative framework supporting the European leadership in development of energy technology and eco-innovation were also included. Guidelines, strategies, specific programmes and, international politics were also chosen to support transport policy objectives, which share many interests with environmental legislation.

10.2 Policy implementation and objective achievements

This deliverable does not seek to establish the level of implementation of legislations reviewed but rather the impacts that these might have invoked on global competitiveness of European transport industry. However, the later will depend on the former. The binding power of a given EC policy[103], the time allotted for this policy transposition into the MS' national legislations, and the characteristics of the MS framework conditions play decisive roles in the level and quality of policy implementation[104].

For instance, the national environmental legislation mostly originates from the EU. Although the environmental issues would call for more binding global policies, yet the global binding character does not signify the environmental policies. In transport policy the share of EU binding legislation varies across the modes and themes. Taxation policy remains a national political domain while internalization of external costs is regulated at the EU level. And although all transport modes are covered by common transport policy, still the air and maritime sectors are regulated by much more sectors-specific legislations than road. The differences between the formal and informal policies may make one to assume that the wider a given transport policy is (i.e. air and maritime), the more informal it would be. However, this is not the case, or at least it does not explain why transport modes with many different geographical operations types, like rail and air are mainly regulated by binding legislation while policy tools related to waterborne carriage signify a higher level of informality.

Big differences exists between transport modes a regards usage of formal transport policy instruments. The air transport binding legislation is mostly composed of regulations while the policy targeting rail market mostly consists of directives and decisions, with the exception of Regulation (EU) No 913/2010 (European Parliament and the Council 2010 b) on European rail network for competitive freight). Directives and regulations apply to road and waterborne transport. How this differentiation may influence the industry is exemplified by discrimination that the National Safety Authorities (NSAs) seem to exercise against private entrants to national rail markets. This could be avoided by establishment of European Safety Authority. The environmental policy, though mostly devised at the EU level, it left up to MS to transpose it into national legal codes and then implement in practice. The reason for that is that the most of the environmental binding legislation are directives.

Furthermore, the specifics of the socio-economic context of each MS cause that the different MS do not start from the same level playing ground. Hence, they may require special measures to implement legislations, such as those aimed at adoption of common standards. For instance, as

[103] The regulations have much higher legal binding power than directives, although the latter need to be implemented within certain time periods as well. In case a delay is observed the EC has the right to define it as legal infringement and bring the case before the European Court of Justice. The court may order the languishing country to speed up implementation process otherwise it may incur financial penalties.

[104] The binding policy legal acts (regulations, directives and decisions) may have higher legal power than no-binding ones such as Joint Technology Platforms. However, impacts of the no-binding initiatives may in certain cases exceed those of binding acts.

regards the passenger transport on roads, the operations of international regular services were impeded by the MS' domestic restrictions. Similarly, the domestic and regional contexts have shaped the effects that cabotage regulation has had on the road haulage market and the entire industry. The same pertains to security at ports. The ability of different nations to implement the security legislation and the value of security itself differs from country to country depending on the availability of economic resources and perceptions of threat. Moreover, implementation of specific policies (particularly those related to public goods like security and environment) although descend from the EC but still require a lot of international policy support. Consequently, the different levels of implementation will have different effects, impacts and consequences for global competitiveness of European transport industry.

As noted in chapter 4, transport is one of the weakest and the most fragmented policy areas as regards the national implementation[105]. This translates into delays in legislation enforcement. The lack of implementation and enforcement hinders in turn achievements of policy objectives. This may possibly be positive or negative for the industry since, some of the policies do not necessarily are devised for the benefits of the industry. An example is liberalisation and market-based functioning of transport services. The MS which have thoroughly implemented this legislation have experienced rail freight growth. However, there are serious doubts whether any further liberalisation of market for air travel will benefit competitiveness of the EU carriers. Further, the level of implementation and thus policy effectiveness also depends on the time given to transpose a given legislation into the national legal codes and then to implement it in practice. This can be difficult to assess for the entire EU since the framework conditions in the different MS may foster or slow the pace of implementation. An example supporting this observation constitutes the assessment of policy on improvement of rail passenger rights.

The legally binding legislation, guidelines and strategies designed by the European Commission and adopted by European legislators for the different modes and areas of European transport policy do not differ much from the publicly supported research. The objectives of the European co-funded and /or publicly supported research can be achieved and outcomes can even exceed expectations. However, they might not be useful for the European industry as long as they do not deliver marketable products, services and applications.

Based on the preceding review, the following table indicates the degree to which the policy objectives have been achieved. Generally, there is a need to improve the level and quality of information on results from the publicly funded research and technology development projects as well as the degree of national policy implementation and compliance.

[105] Transport is on a par with environmental protection policy whose implementation also lags behind the deadlines for policy adoption and enforcement.

Table 18: Qualitative assessment on the compliance of policy objectives (high: green, medium: lilac, low: orange; assessment was not possible: grey)

Transport	Environment	Security	Industrial Competitiveness	Social and Consumer-protection	Energy
TEN-T: an efficient, seamless, sustainable single and multimodal network	Mitigation of climate change	Safeguarding people, industrial installations and societal functioning.	Balance financial support, practice and restructuring needs with demands for free competition	Improve working conditions in rail sector	Decouples energy consumption from mobility growth
Promotion of intermodal transport	Improvement of the air quality	Incident prevention and risk reduction	Facilitate access to financial resources	Improve working conditions in road sector	Improvement of transport energy efficiency
Expansion of the EU common transport beyond its borders	Reduction of GHG emissions	Provision of a common security framework in air transport	Protection against counterfeiting and piracy	Improve working conditions in maritime sector	Improvement of vehicles energy efficiency
Harmonization of technical standards of rail systems	Reduction of noise	Expanding capacity to adopt alternative security measures	Transparent and open public procurement	Improve working conditions in air sector	Reduction of transport sector's GHG and CO2 emissions
Development of rail infrastructure network	Reduction of waste	Improvement of passengers' trust in the security of air transportation	Cross-border procurement	Harmonize working conditions in rail sector	Development of a market for clean and energy efficient vehicles
Enhance the interoperability and integration of MS' rail networks	Increase sustainable use of resources and energy	Improve monitoring of security in air transport	Integration of environmental, social and innovation considerations into public procurement practices	Harmonize working conditions in road sector	Promotion of the bio-fuels and other renewable energy sources for transport

Increase efficiency of rail freight transport	Influence consumers' and users' behavior towards more sustainable transport	Raises level of security in maritime transport	Turn innovation into an overarching goal of any policy	Harmonize working conditions in maritime sector	Provision of collaborative framework
Increase the share of rail traffic in freight and passenger carriage	Incorporation of GHG transport emissions in ETS	Facilitating homogeneous interpretation of rules	Deployment of market ready products	Harmonize working conditions in the air sector	Leadership in energy technology and eco-innovation
Creation of a rail certification system at EU level	Reduction of hazardous substances in vehicles manufacturing and promotion of recycling	Creates comparable levels of security at all EU ports	Removes trade restrictions and fortifies provision of fair trade conditions	Increases quality of jobs in the rail sector	Liberalisation of energy market
Internalisation of external costs, especially those of road transport	Reduction of hazardous substances in manufacturing of vessels and promotion of recycling	Increase security of shipments entering or leaving the internal market	Facilitate internationalization of European business	Increase quality of jobs in road sector	Diversification of energy sources
Avoid discrimination and facilitate cabotage in coach and road haulage	Better monitoring and reporting of GHG emissions	Development of high security systems	Upgrades skills of workers	Increases quality of jobs in maritime sector, attracting workers	European energy market integration
Reduce environmental footprint of transportation, especially of road	Promotion of inter-modality (focus on railways and IWW	Improved access to emergency systems	Promotion of entrepreneurship	Increases quality of jobs in air sector	Development of renewable energy (general)
Promotion of inland waterways (IWW)	Internalize external costs	Facilitation of cross-border procedures	Secures access to natural resources and sustainable consumption	Reduce accidents and improve safety in the rail sector	Increased energy efficiency (general)
Promotion of Short Sea		Adaptation to evolving	Supports adoption of	Reduce accidents and	Exploitation of

Shipping (SSS)		security threats	CSR principles	improve safety in the road sector	indigenous energy resources
Promotion of maritime transport with common worldwide standards			Fosters demand for new more energy-efficient vehicles	Reduce accidents and improve safety in the maritime sector	Unifies and strengthens EU voice in negotiations with extra European energy supplying countries
Facilitate market access to air service providers			Improves market chances for intelligent aircrafts	Reduce accidents and improve safety in the air sector	Development of necessary infrastructure
Increases fair competition between air service providers			Increases vehicle safety, efficiency and reliability of services	Enhances protection of railway passenger rights	
Improves slot allocation			Improvement of manufacturing and assembling processes	Increases protection of road users rights	
Improve the functioning of the European aviation market			Create innovative solutions in the logistics and supply chains	Increases protection of maritime user rights	
Increase the capacity and cost-efficiency of air				Increases protection of air passengers' rights	
				Facilitate access to disable people	

10.3 Summary of impacts

In addition to MS' national conditions which influence the level and quality of implementation of the European legislations, there are (at least) five other issues which make an assessment of impacts of European policy on global competitiveness of European transport industry quite demanding. The first is impossibility to measure the impacts of one piece of legislation, because individual effects are influenced by other interlinked policies and a plethora of implementation conditions. The current economic crisis is one of the factors which delayed the implementation and enforcement of environmental policy. The environmental protection seems to be quite vulnerable to economic conditions as environmental goals seem to be of lesser importance under economic crisis. As a consequence, it is quite impossible to discern whether the reduction of environmental footprint could be attributed to improved environmental performance or to considerable slowdown in European production and consumption. Second, the impacts of some recently adopted legislation are not yet visible. However, even in the case of legislation adopted long time ago (such as Directive 92/106/EEC promoting the cross-border intermodality of freight transport), insufficient reporting from market monitoring systems exists. The difficulties of inter-temporal and inter-regional measurement of implementation advancement hinder establishing whether this policy' objectives have been attained and, if so, what consequences they might have on the target industry. Third, the lack of publicly available studies analyzing industry impacts has made this assessment problematic. The extant studies focus mostly on health and social impacts and not so much on competitiveness of European transport industry. Fourth, certain policy areas such as security or environment are public goods which are not limited to national or even European borders. Hence, their enforcement requires international agreements and accords. It is, thus, difficult to implement them without international support and assess impact that these legal acts might have produced in the absence of international legal framework. Fifth, some policies (especially the environmental protection, energy efficiency and security policies) aim at reducing risks which might arise if legislation and the companying measures have not been adopted (such as that of the cost "saved" from preventing security incidents). The assessment of these benefits as compared to losses so far incurred is complicated because we do not know what magnitude and severity the future disasters might bring about. Some retrospective assessments of measures effectiveness could be done, but not the impacts on entire industry.

Still, the literature reviewed enabled us to extract some results. First we summarize those which apply to all transport sectors. Then, the specific impacts which are considered to be more relevant for the European transport industry's global competitiveness are described for each transport mode and sector.

The EU policies have been supportive of both the industrial and the European co-funded research. The European research has been sponsored by the successive Framework Research Programmes, but also by establishment of European Technology Platforms and Joint Technology Undertakings. Though the research projects that the ETPs and JTU promoted mostly target the specific areas, still the ETPs and JTU activities have some common goals and, therefore, might have enhanced the competitiveness of European transport manufacturers and service providers in all sectors. They

might have done so through

- Increasing a degree of certainty and confidence which companies and industries need to undertake the necessary investments
- Securing access to financial and human resources
- integrating knowledge and resources to enhance financial investment and increase the scale of their outcomes
- Creating applications for market deployment
- reducing the costs of designing and manufacturing of vehicles, vessels, transport equipment and applications for transport service and devising efficiently operating services
- Creating synergies and shared knowledge, which in turn might have contributed to innovative thinking on how to approach the problems constraining the entire European industry
- Developing transport solutions for the entire transport industry instead of just specific transport modes.

In addition, the ETPs and JTUs might produce future impacts that have not yet fully materialised because technologies and materials explored are not yet applied in consumption of current products. The benefits listed above as well as those produced by innovative technologies and systemic changes such as increasing the capability for future manufacturing or new management of supply chains may improve profitability of industrial research, increase market shares and business revenues, thus providing funds adding companies with resources for long-term investments. In this way many companies might have increased their capabilities for more value-added, resource utilization, reduction of negative externalities (emissions and waste), and enhanced market responsiveness. These factors might have collectively fortified the European industry's competitiveness.

The same applies to the EU supported industrial research. The large projects such as TEN-T and GALILEO created innovations that all transport modes have benefitted from. In addition, deployment of Intelligent Transport Systems (ITS) can also benefit all transport sectors because its application is enhanced by GALILEO; together these two enablers might reduce the traffic delays, environmental impacts, improving arrival predictability and energy efficiency. However, we cannot ignore that some concerns also exist as to whether this EC supportive public function may endanger the industry's own abilities to innovate and compete.

All of these policies may induce impacts with both positive and negative effect. The final result will depend on which development areas they target and how the European transport industry's value creation is dependent on its proprietary or public research and investments.

Traditionally, transport policy targets the specific transport modes. However, there are transport policy objectives which may impact the entire industry; by shifting passengers and goods from the less efficient or unsustainable road transport to better performing rail and waterborne transport the entire structure of European transport industry may be changed. The opening of HSR attracted passengers from domestic and regional air travel segment. At the same time, some railways lost

market shares to the low-price air carriers. Unfortunately, the shift of freight from road to rail has not happened yet. In fact, the policy on shifting goods carriage from roads to railways and IWW has not been very successful. As recognized, there is a strong link between the transport and environmental protection policies, which as yet has not been explored adequately. The European market-deployed products and services which comply with environmental sustainability standards may give the European transport industry competitive boost if demand for such items arises in the other parts of the world. However, as far as one can see, public support to reduce environmental footprint in other regions of the world is not as strong as in Europe. Adding to the complexity is the fact that those regions are more "energy independent" than Europe. So, the demand for such services and products might be quite limited at least in the short and medium terms. One may thus conclude that public policies do matter. But, the European transport industry' integration in the global economy, ability to create jobs and innovate, and compete with overseas rivals depends on the myriad decisions called the market.

Security policies may impose additional compliance costs on companies, especially the small ones, thus reducing their revenues and ability to compete. Particularly, when customers do not perceive security enhancement as value-added, additional security outlays may become the sunk costs. On the other hand, however, implementation of security legislation may save costs by reducing probability of incidents and disasters. Furthermore, security policies may increase customer trust and willingness to pay for security. In this case, security improvement may add value to transport services and/or products, turning high security standard into competitive advantage. However, such conditions do not seem to prevail at present. The European policies targeting common security approach may reduce the costs for European transport companies, but if European security policies are more restrictive than those in overseas destinations, they inhibit the European industry in competing on equal footing in global markets. However, if the global security threats increase, something which is not unthinkable due to the increasing emergence of social conflicts, stronger security compliance may turn into comparative advantage. In this case may overseas consumers and users may prefer European vehicles, vessels and air transport equipment, spending their holidays in Europe or moving goods across European territories and well protected air or maritime networks. Under these circumstances, the European policies have

- Reduced the physical and personal levels of risk, also those derived from driving vehicles, operating vessels and using air transportation
- Reduced vulnerability of transport to the different types of incidents
- Improved knowledge of cargo positioning and networks surveillance and
- Introduced security checks and safe customs procedures, thus making the intermodal and cross-border transport of goods and passengers more safe and punctual.

All these factors add to competitiveness of the European transportation industry against rival manufacturers and suppliers whose products and services display lower security standards.

The EC industrial competitiveness policy influences all European industries. Hence, some of its impacts cannot be limited to a single transport mode only. The success of a policy attracting e.g. FDI, would be heavily influenced by policies on education, mergers and acquisitions, productivity and employment, and innovation. In addition, policies encouraging technical efficiency either by

providing manufacturing assistance or though inter-sector technology transfer, reverse engineering or imitation, labour productivity, international trade, protection of patent rights and other intellectual property, facilitation of re-investment and long-term investments, and promoting access to export markets may also have a great say in competitiveness enhancement. When it comes to the impacts of policies on outward FDI, we can also think of both positive and negative effects. The benefits may accrue from lower production costs, value chains specialization, improved access to markets with high demand levels, and ample natural resources and more advanced technologies. The negative consequences may arise from job-exporting, innovation leak-outs, high exposure to local red-tape and bureaucratic barriers and sometimes (negative) national sentiments, high-adaptation costs to new work culture and business environment, and higher business risk due to reliance on local business service providers. The negative effects can, at least to certain degree be counteracted by policy instruments such as the Gateway Programs and the Executive Training Programs which help reduce business risks, better assess foreign opportunities and improve market knowledge, and by so doing overcome the internationalization barriers. In some cases these hindrances may be removed and the scale of international business increased. In other instances, export activities, licensing or franchise agreements can be signed shielding the European industries from very high risks of production outsourcing.

Inclusion of environmental, social and innovation principles into public procurement have not yet been implemented fully. However, one may expect that both the negative and positive impacts may ensue. Negative effects may arise from higher use of resources and time and more administrative burden. On the other hand, the possible benefits may encompass support for innovative products and services for which market demand has not yet sufficiently evolved, higher sustainability awareness, which, if properly managed, may improve the European business performance and overseas reputation. Higher openness and transparency of public procurement have already increased competition levels and reduced the time and money spent by public purchasers. However, the EU procurement legislation deemed to be somehow more burdensome than some national procedures are. Furthermore, the cross-border standardization of procurement has not yet progressed as expected due to the rules variability, insufficient training of officers, and inconsistent and rapid policy changes. This has negatively affected private suppliers, and particularly SMEs who suffer from resource scarcity. The new currently proposed legislation foresees usage of electronic communication tools, reduction of administrative barriers and, assignment of policy implementation control, monitoring and reporting to specific national authorities. The hope is that these measures might facilitate implementation process and achievement of policy's objectives.

By stabilizing or easing access to financial credit the state-aid diversified financing sources and increased investment capacity for European business. In addition, many individual businesses but also the entire industry sectors benefitted from public funding of research activities. This supported high-risk innovations, improved quality of some novel products and services, created new markets through public procurement and reduced manufacturing costs. The scope of these benefits was also enhanced by establishment of ETPs and JTU. One may expect that the recent the Bond initiative which targets development of transport infrastructure may also benefit the transport industry. However, insufficient or late implementation of IPR legislation may cause loss of market shares and discourage investments. Finally, proliferation of CSR principles may reduce operations and production costs, increase productivity and reduce environmental impacts. Because the CSR

policy pertains to all stakeholders in a given industry and all affected parties it may improve the corporate image and customer loyalty, and attract more R&D investments.

In parallel to security and environmental legislations, the attainment of social security, consumer protection and consumer safety policy objectives requires quite substantial financial outlays. Some of these measures such as better professional training, improved working environment and integration of workers' needs into everyday operations, more spending on industry-driven research and risk prevention, and more detailed investigation of work accidents can be seen in the short term as additional burdens by the industry. Whether these perceptions will remain negative in the medium or long-term will depend on 1) how quick the industry may capitalize on the above improvements by delivering safer service, and more transparent information which better protect the customer rights, and generally, provision of higher quality products and services produced by highly skilled, satisfied and loyal workforce, and 2) whether there is demand for such products and services.

Similarly to security policy, the benefits of social security and consumer protection policies will depend on how aware the transport customers and end-users are about the real value of the safe and fair products and services. The CSR policy can help to promote the significance of these values.

The energy policies are especially relevant for transport industry because of Europe's dependency on extra European energy sources and supplies. Therefore, the objectives related to diversifying the energy sources, reducing external dependency and improving consumption efficiency will benefit the entire European industry and citizens. Energy security might be improved by making the extra European supplies more reliable, but also by increasing reliance on renewable and indigenous energy sources. However, the impact of the later on competitiveness of the European transport industry will depend (again) on whether the European consumers will be willing to purchase more sustainable products and services. The fact that at the current stage the renewable energy is quite expensive creates uncertainty as to whether sustainably manufactured products and services may gain competitive advantage for the European transport industry

In the following we summarize the expected impacts on competitiveness of the different transport modes and industries.

10.3.1 Impacts on railway industry

Rail services

Although rail liberalisation has not achieved the expected modal shift and the level of competition remains low, still market opening changed the industry structure and business models of its operators. This in turn led to consolidation of international rail service, thus improving railways performance. Making national rail networks more interoperable has fared slightly better. Although here too installation of ERTMS on the main European corridors to increase infrastructure capacity, efficiency and safety and reduce costs of maintenance and personnel training was progressing at slow pace. Overall, the attractiveness of rail services has however improved. Yet, due to the lack of reliable data it is not yet known, how the recent pricing reform affected the entire industry. Few studies indicate some positive effects such improved service quality and availability, passenger

satisfaction and traffic growth, and lower public subsidies. On the negative side however, the volumes of international freight in Central and Eastern European countries did not grow much due to the high levels of infrastructure charges. Overcharging for infrastructure may distort the efforts to increase competition in the entire European rail market.

At the present stage it is quite unknown how the process of rail liberalisation may proceed, and with what results. One less optimistic view is that a more liberalised market may pressure down transport rates which in combination with the lack of public subsidies may reduce the rail service quality. As a result, more frequent arrival delays and longer transit times in rail transport may divert traffic from rail to other modes. A more upbeat view maintains that the new private entrants may change the industry structure and enhance the level of competition as a consequence of which, rail service efficiency and quality will improve. The attainment of several other objectives described in the 2011 White Paper, such as better connectivity between railways and other transport modes (ports and airports), better network infrastructure and traffic management may heighten operations efficiency and help rail to attract more passengers and freight. However, introduction of maximum noise level limits for rail operations may increase operations costs, and possibly, also lead to loss of market share. Yet, considering that the policy only recommends retrofitting of rail wagons without imposing the new noise limits on infrastructure, the compliance must not be so expensive in the short-term. In the long-run, however, the EU wide proliferation of common and binding noise restrictions may facilitate production of more silent rolling stock and traction equipment , and by so doing, create a comparative advantage which the European rail equipment manufacturers may utilize in global markets.

The European regulators, European rail industry and the MS work on improving rail safety, reducing accident frequency and the accompanying social and economic losses, lowering of rail equipment's life-cycle costs, and generally, increasing the user confidence in rail transport. Many European rail projects seek to reduce travel/transit times and the EU-wide costs of safety certification. Measures reducing environmental footprint and health impacts may also infuse rail transport with benefits created by noise, emissions and vibration reducing innovations. As a consequence, the European highly environmentally performing rail equipment may become well placed for meeting global demand for sustainable rail transport.

Freight

Although the liberalisation of rail freight has not yet delivered the expected results, an upturn in rail freight volumes was observed in the MS which speedily implemented this legislation. Thus, the problem with implementation of rail freight liberalisation seems not to consist in poor design of policy mechanisms, but more in the lack of compliance on the part of some MS. The investments in TEN-T network made the transport infrastructure more interoperable and passenger rail more competitive vs. air and even car. However, some unfinished work still remains which needs to be completed before more liberalisation benefits could be attained. These include

- Full deployment of ERTMS
- Investments in infrastructure improvements on some important European corridors
- Better interoperability with other modes

- Improvement of rail operators' financial health so that they become capable to renew the fleet and restructure operations, and
- Inclusion of research outcomes into industrial applications.

When these subtasks are completed one can expect that the European rail freight transport might become one of the most modern, efficient and interoperable systems in the world.

Passenger

The liberalization of passenger rail increased competition and reduced the HSR ticket prices. This attracted passengers from air travel. In addition, better passenger information and good protection of user rights also improved rail image and increased its public acceptance. Hopefully, the lower environmental footprint and less rail accidents will over time attract more traffic from regional airlines, private cars, and coach travel segments.

All these socio-environmental changes may make the European transport more sustainable. However, higher level of intermodal competition may reduce demand for 1) private cars and coach transport, and 2) regional air services, negatively impacting the European airlines. However, the net changes in the European modal split will depend upon how the competing transport modes will upgrade their service standards. The latter pertains more to the intra EU competition than to the contest between the European and the overseas transport equipment providers. Still, because the rail passenger services do no not compete in global markets, higher passenger numbers on European railways may financially strengthen European rail carriers. This may enable them to offer services abroad. Yet, doubts remain as to how these efficiency and quality improvements in Europe will be accepted by global markets where rail transport usually falls under the national governments decision domain. For this reason less environmentally friendly but locally manufactured rail equipment may be preferred[106].

Rail equipment manufacturing industry

Higher intermodal competition and lower ticket profit may motivate European manufacturers to export more rolling stock and more rail communication and signaling systems. Yet, the persistent price pressures may also increase safety risks for transport users and rail workforce. Combination of strong price pressures and the lack of public support may reduce the quality of service, decrease demand for passenger rail, and the rail export orders. On the other hand, however, such pressures may also foster innovations in operations efficiency and cost reduction. In addition, one may also expect that application of ERTMS beyond its original field of usage (HSR) may reduce the price pressures and increase demand from extra European countries. Since ERTMS has devised new signaling technology and promoted infrastructure development, it may become an attractive solution for overseas countries which want to modernize their rail systems. This may spill over to the lateral industries which also offer highly socio-environmentally sustainable solutions from Europe**.** In addition, the competitiveness of European rail equipment may benefit from research into

[106] Railway Gazette International from September 20th, 2013 brings news that European manufacturers of multi-system locomotives (Siemens and Stradler) and passenger rail cars (Siemens and Bombardier) are rapidly increasing their exports to Russia, Ukraine and Azerbaijan.

new generation of transport technologies that reduce life-cycle costs, usage of new materials, optimisation of design, production and assembling processes which shorten the market deployment time. Furthermore, the Europe-wide harmonization of certification procedures and introduction of competitive tendering will foster equipment standardization, and reduce production costs in Europe. Depending on whether the new income sources exceed the investments required to improve the quality of rail equipment, the growth in extra European demand may increase profit margins for European manufacturers.

Yet some concerns still prevail. Although the safety standards have been harmonised, one should not assume that common standards will bring benefits to all stakeholders. The social and the economic benefits might be higher if the harmonised standards make the equipment safer. However, what if the opposite happens? In addition, the existence of diverse rail safety standards may require greater flexibility from the European manufacturers. This may make them more capable to adapt to global markets whose standards differ from the EU internal market.

10.3.2 Road industry

The application by the European manufacturers of cars and commercial vehicles of research outcomes which quantified the costs and benefits of socio-environmental improvements (such as low-priced low-noise tires and low fuel consuming engines) improved the industry's sustainability image, which also may improve its global competitiveness. Yet, the industry's ultimate export gains will depend how on much the European manufacturers manage to impress the overseas buyers in contest with their most staunch rivals.

Road haulage

Although the road user charges in Europe (the so called vignettes) account for very small share of final service price, several studies have shown that introduction of external cost taxes increased the costs of the entire transport chain and reduced freight volumes in road transport. Better trip planning and higher vehicle utilization were the short-term measures which increased operational efficiency. In the longer run, one may expect that these taxes may foster new investments in technology improvements, fleet renewal and organizational changes, all of which may increase competitiveness of the European motorised freight industry. It seems to be a link between the tax charges and efficiency gains because of evidence that the MS increasingly shift their load carriage to much heavier vehicles.

Even if liberalisation of road haulage has not has not as yet delivered the expected outcomes, several studies revealed some positive effects. Introduction of community-wide licensing system brought down the administrative barriers hindering operators from the new MS to access the freight transfer internal market, diminished the numbers of empty runs and improved hauliers revenues. The ultimate scope of liberalization impacts depend on ability of the different country hauliers to adapt their business models so that they can earn money in highly competitive market (Germany vs. France). However, it is quite unclear whether cabotage regulation is alone responsible for high price pressures, concerns about workforce shortages and operations safety, and increasingly more preponderant flagging out of freight operations by hauliers from EU-12. Here again the other socio-

political factors (enlargement of EU, differentiation of legislation enforcement, availability of human and budgetary resources, the features of national socio-economic contexts, regulatory regimes and geographical conditions) might have played a role in addition to market opening. It was also been observed that the cabotage regulation's intrinsic limitations might have also diminish efficiency gains from higher competition. On the other hand, the short-term increases in operations costs imposed by improvement of workforce qualifications and higher safety requirements might have reduced the European operators' competitiveness against operators from countries with lower social standards. In the long-run, however, safer road operations and better qualified workforce may increase customer satisfaction, reduce costs associated with accident prevention, and enhance demand from extra European countries.

The use of ITS and electronic communication solutions (devised by research in the space industry), may not only improve efficiency of toll collection, but also prevent accidents through provision of emergency call and accident reconstruction system. Combined with more advanced driver assistance systems these breakthroughs may help road transport forwarders and logistics operators to prevent accidents. Anti-theft monitoring and other applications which enhance traceability of goods and identification and location of operation disruptions may help logistics companies to react more swiftly, re-arrange operations and reinstate service continuity. If adopted and utilized, these technologies will make European operators better capable to improve service reliability and increase customer satisfaction. Successful application of the devices may make customs and security controls more efficient and improve the personnel and cargo security. In addition, innovations improving engines fuel efficiency in new vehicles may save costs and reduce environmental impacts. In this way the cost effectiveness of freight forwarders will be improved, thus, enhancing competitiveness of European logistics services in global markets.

Passenger market

When charged for the use of infrastructure, private light vehicles' drivers may select other routes and/or transport modes to avoid taxes. This behaviour might increase revenues for car substituting modes, but have little impact on global competitiveness.

Similarly, even if impacts of liberalisation of the coach market differ greatly from country to country and are not yet fully assessed, at they won't be of great relevance for global competitiveness of European coach transport industry**.**

Vehicle manufacturing industry

The provision of state-aid have helped the European car manufacturers to develop "greener" vehicles. In addition, introduction of research outcomes into mainstream manufacturing by European automobile makers increased demand for highly skilled workforce. Yet, whether this will prevent relocation of manufacturing operations from Europe to overseas industrial centres is however, impossible to anticipate.

Additionally, research results advancing vehicle hybridisation and electrification, applications of new fuels and integrated mobility systems, new ways of using the new and old materials, and vehicle adaptations for usage by disabled people may spur long-term investments leveraging the knowledge outcomes. New investments in fleet renewal to reduce external costs may also benefit

vehicle manufacturing industry which products may also benefit from increased demand for "environmentalism" in other world regions.

However, there is not enough evidence to conclude that vehicle taxation may influence consumers' choices towards purchase of less polluting cars. Although, over the last years the CO_2 emissions from the new fleet have declined, this might have happened due to other causes. Nevertheless, it seems reasonable to assume that taxation of polluting and inefficient road transportation through weight-distance and smog fees may increase demand for cleaner cars and commercial vehicles and motivate operators to better optimize their transport routes operations. In fact, the taxation targeting the car-sharing schemes which originally sought to reduce the car purchases increased the sales of more fuel-efficient vehicles in Stockholm.

Neither is it possible to establish the full impacts of policies promoting clean and energy-efficient road transport through public procurement. One reason is that implementation this legislation was delayed, another is the lack of adequate data. Similarly, the implementation of legislation promoting sustainable management of private vehicles' life cycle has also been delayed too due to high administrative burden of its enforcement, the reluctance from on the part of MS, exports of used vehicles to countries with lower environmental standards, and development of a parallel black markets. Measures promoting recycling and limiting usage of hazardous materials in vehicle production, as well as IDIS system enhancing pollutant transparency may also increase the competitive position more sustainable vehicles.

Also, although the legislation reducing noise from road transport is based on international standards, its impacts on global competitiveness might be limited. As the international standards did not deliver the expected results, a new legislation has been proposed. This provision will adjust the noise assessment methodology in line with real conditions and minimise sound levels of from electric and hybrid vehicles at low speeds. If implemented, these standards may benefit competitiveness of European car manufacturers.

Furthermore, the availability of data on vehicle emissions and fuel consumption may improve the European automobile makers' competitive advantage if consumers will use this factor for making the vehicle purchasing decisions. However, if consumers will not do that, then the value of this information will not add the clean vehicle manufacturers with competitive edge. Besides, demand for automobiles in global markets such as China grow at much higher rate than in Europe. This may motivate Europe car manufacturers to invest in vehicle production facilities in these markets.

Increased levels of safety for road users can also boost demand for such services. However it is not clear how this may affect global competitiveness of car and commercial vehicles manufacturing industry in global perspective.

10.3.3 Waterborne industry

Inland Waterways

No empirical evidence supporting positive impacts of RIS harmonization on global competitiveness of IWW transport was fund. However, the policies aiming at harmonization of technical

requirements for electronic ship reporting in inland navigation may reduce the administrative burdens related to information exchange. Yet, the future possible positive effects may accrue from lower operational and stand-by costs, improvement of voyage planning and better utilization of loading capacity and higher terminal efficiency. Also, optimisation of cruising speed with the consequent reduction of fuel consumption, delays and waiting times, accidents and insurance costs can also emerge in longer terms.

Other policies have, also to some extent, improved the market and human capital conditions, fleet, and industry image and infrastructure. In addition, the transfer of goods from roads to SSS seems to have been effective in Italy and Spain. Other policy measures seeking to increase transport of goods by IWW, may also attract higher volumes. However the impacts of such benefits on the competitiveness at a global level are uncertain. To some extent, it will depend on whether the IWW segments are a part of global value chains, and whether these positive effects can improve the quality of global logistic service.

Maritime services

Simplification and harmonisation of reporting formalities and research support policies fostered collaboration between researches, industry and policy makers However, as few expected positive impacts have materialized so far, the scope of positive influences that these measures may induce on European maritime service industry is not yet possible to define.

Due to lack of implementation, neither the objectives of social security nor consumer protection policies have been achieved in the maritime sector. So here we can only expect that some benefits will emerge after implementation has been accomplished in the future. One set of positive outcomes may materialize in higher quality of service and passenger satisfaction. Another may emerge from reduction of numbers of safety incidents, employment of highly skilled and efficient workforce, harmonization of safety standards in international waters and improvement of traffic surveillance which collectively may reduce the costs of maritime operations.

Although the EU environmental legislation related to maritime industry exist at the EU level, most of its provisions encompass global standards and agreements reached through international accords within the framework of diverse initiatives (e.g. Barcelona Convention) and international organizations (IMO). How the transposition of these agreements has affected the EU-flags is uncertain since implementation has been hampered by the lack of data, non-ratification on the part of some MS and the lack of funding. This may not be the case with implementation of EEDI and SEEMP, which are expected to be cost-effective, save fuel consumption and reduce the level of investments required. However, how the legislative frameworks which apply to all vessels irrespective of their flag may affect global competitiveness of European maritime sectors is difficult to establish since all players must follow the same rules. This seems to be especially the case with ship-source pollution arising from accidents and deliberate discharges, as tank-cleaning operations or waste oil disposal as regulated by Marpol 73/78. In addition, international research has showed that ship-dismantling practices are not always performed in accordance with existing legislation. However, the EU companies involved in the EU supported projects may benefit from early adoption of new fleet and navigation systems with reduced energy and fuel consumption and lower risks of environmental accidents.

Applications developed with partial public funding have improved coordination of container ship-to-ship transshipment and ship-to-shore operations, port navigation, shore-to-ship management and calamity abatement. Furthermore, the benefits expected from better sea surveillance and data exchange on security conditions may enhance the quality of European flags. Moreover, these measure may also improve security of global maritime services, even the global transport services because breaches of maritime security may invoke serious consequences for the entire industry and global economy.

Higher costs of operations at certain ports caused by higher-than-average security enforcement can shift cargo flows to other ports. But this has little relevance for global competitiveness of European ports because European ports compete with each other rather than with those in Africa, Americas or Asia. Security policy might have reduced the inter-port competition to some degree through introduction of larger cargo ships in response to higher operations costs at ports, to which security protection also belongs. This global trend does not however, exclusively affects the European maritime service industry. More relevant seems for global competitiveness seems the policy aiming at expanding the EU regulations to neighbouring regions outside the EU. Since this policy facilitates development of transport infrastructure and simplifies procedures for border crossings in new markets, it may benefit the European maritime and logistic service providers.

Shipbuilding industry

The state-aid and the block exemptions have both helped the sector in access to funding and thus preventing that more EU-flags leave the EU legal jurisdiction. This, combined with voluntary agreements on IPR compliance in foreign market may retain maritime jobs in Europe. In addition, several research projects together with ETPs and JTU collaboration reduced the design and construction life cycle costs of vessels, devised new techniques for cargo transshipment and energy efficiency, and reduced ships environmental impacts and accidents. These achievements have improved manufacturing processes which benefited the European maritime service and vessel providers. Similarly to other transport modes, better cooperation and networking may translate into benefits along the entire ship production chains. In summary, the European shipbuilding industry's capacity to modernise was enhanced by the EC funded research programmes aimed at reduction of the waterborne shipping industry and the IWW vessels environmental footprint and adoption of other innovations. Whether these measures will improve global competitiveness of European shipbuilding industry will depend on how the ships built in overseas locations perform on the same parameters and what would be their delivery price.

10.3.4 Air industry

The liberalisation of air travel industry increased demand for air service. This has in turn enhanced demand for aircrafts and air navigation and communication systems, enhancing the scale of production and the sales levels of avionics industry. The backsides of these developments emerged as large growth in air traffic, congestion and environmental pollution. This happened because the measures to tackle these negatives have not been deployed as envisioned. Nevertheless, extensive research into the aircraft and air navigation systems production has established that European

aviation industry retain high technology position in the world, and contributes to developments of aircraft manufacturing and service provision industries.

Air passenger services

The liberalisation and privatisation of air travel industry and infrastructure facilitated entry of Low Cost (air) Carriers which increased competition and reduced the fare prices. This affected working conditions of flight personnel and ground service providers. The LCC have also been responsible for development of regional airports as the slot capacity at main hubs was limited or reserved for the incumbent flag carriers. Emergence of new segment within air travel which made air travel more affordable has also stimulated tourism industry. Overtime, the incumbent airlines have been affected by rivalry from the low costs competitors, who earned enough money to invest in long-range aircrafts and expand their service offerings to inter-continental routes. Another effect of market opening consisted in higher level of rivalry between the regional and the incumbent airlines which spilled over to rail travel segment. There is evidence that the number of second class rail passengers decreased on routes served by both the rail and airlines, while numbers of those using HSR increased or grew slowly. As the air traffic volumes grew vigorously, the existing airports turned into bottlenecks. The current slot allocation system which tied up airlines to main hubs could, to certain degree, be blamed for airports incapacity to increase efficiency and service offerings**.** Another part of the blame could be ascribed to delayed implementation of the SES and SESAR which we meant to make air transport more efficient, safe and sustainable. As a consequence, regional airports were developed to offer capacity needed by LCC. In the end, the competition between the large and the regional hubs has increased which eventually released some additional capacity at large airports and also pursued them to invest in capacity expansion. The latter has actually happened in Amsterdam, Stockholm, Copenhagen and Frankfurt a/Mein.

The new proposed legislation allowing the secondary slot trading is expected to alleviate the capacity problem, stimulate traffic growth and lower administrative costs for users. But here again, in similarity with the SESAR, we can only talk about positive expectations. Besides, it is not clear whether the measures proposed shall generate any positive impacts at all. There are three main concerns which may negatively affect the European aviation industry. First, airlines may start running empty flights to keep possession of slots with negative impacts for their operations cost and environment. Second, new legislation could benefit more the non-EU carriers and new entrants than the established incumbents. Third, the new measures could negatively impact the regional carriers, their employment and access to long-haul flights from peripheral regions.

The proposal on common charges have also some backsides. It allows each airport to find the best way for charges collection. On the other hand, unequal practices between airports may harm airlines which are bounded to certain airports through slot allocation. Furthermore, policies targeting noise reduction of flight operations at and around the airports may also distort competition despite the fact that the EU legislation only transposes international standards agreed by ICAO that are meant to apply equally to all airports and carriers.

With regards to emission reduction, the EU legislation has proposed inclusion of aviation emissions into the EU ETS. However, the implementation has stalled due to international opposition. Yet as research has shown that fuel prices play a more decisive role in aircraft innovation, the emission

reduction does not need to produce the immediate benefits. However, from the competitiveness perspective, this might depend on whether the EU carriers will pass such outlays onto final users and whether the extra-EU operators can do the same.

The security policy is still another example of how difficult it is to regulate the global industries with global impacts. Generally, reducing the risk from terror incidents may preclude loss of human life and equipment, and air traffic disruptions which are very costly for aviation industry. At a company level, higher security standards can attract more passengers. However, security standards at all airports require harmonisation. Yet, despite implementation difficulties certain achievements have be recorded. Many of the improvements in environmental protection, safety, ATS efficiency, security, and service quality can be ascribed to the EU co-founded research undertakings. Moreover, compliance with performance regulating agreements increases legal certainty for the EU airlines operating in extra EU countries. The latter is significant for establishing new business in non-European locations and opening new routes to high-growth markets.

Furthermore, the European carriers have benefited from airline alliances allowed by competition policy regulating the inter-airline concerted practice. However, the positive impacts in the form of lower-per-passenger costs, higher capacity, lower fares, improved schedules (with consequently increased customer satisfaction) did not benefit equally all European airlines thus precluding the overall gain in competitive advantage. The air travel industry has also been successful in improving safety standards (by keeping accident rates constant despite large growth in air traffic), protection of passenger rights, working conditions for aircrews and their work performance. All this may give European carriers a comparative edge when/if passengers select European airlines over overseas carriers.

Aircraft manufacturing industry

The market entry of LCC has changed demand for aircrafts because they purchase many aircrafts from one single aircraft maker. This has affected the way the manufacturers compete for large orders and price their deliveries.

The inclusion of aviation's emissions in the EU ETS may not be so important for the aircraft manufacturing industry because the costs of new fleet development exceed by far the costs of trading the emissions. This means that emission reduction alone will not probably be a sufficient incentive to develop new aircrafts. Rather further growth in fuel prices will become a more critical factor. Against this background, the putative climate change is not seen as an immediate inevitable reason for increasing prices of the CO2 emissions bonds.

The European and non-European aircraft manufacturers and public institutions collaborate strongly to develop the "biofuels" and generally, to make the aircraft manufacturers and service providers to apply systems (e.g. AIRE, SESAR) which will make them more sustainable. In this context, doubts prevail whether a sustainable competitive advantage may accrue to European operators when all players in this business become more "green". However, if European manufacturers cannot supply the European carriers with the adequately clean equipment, they will purchase aircrafts from the EU external providers. This of course is also applicable to overseas operators (unless legislation impedes purchases of European aircrafts by overseas airlines). This may particularly apply to

deployment of silent airplanes as airlines need to comply with the increasingly growing noise restrictions at airports.

Research projects have reduced the costs of aircraft design and manufacturing lead-times, and market deployment times. Research work has also contributed to development of new turbine engines and integration of the entire avionic supply chains. These breakthroughs contributed to launching of new aircrafts that carry more passengers and/or consume less fuel and emit less emissions. In this way, the public and private investment in aeronautics research has paid off. The European tax regime might have also come to the good of Airbus and gave the European manufacturer some advantage over its counterpart.

10.4 Impacts on competitiveness of European transport industry

As pointed out this work seeks to assess how the European policies may influence some elements of global competitiveness of European transport industry. This is done in the tables below.

The first table assesses how the different policy objectives address the key competitiveness elements. The second table reflects on how the competitiveness of the different transport industry segments are affected by the different policies. A negative sign does not necessarily mean that a given policy influences negatively a particular industry element. It can also be caused by the lack of sufficient policy implementation. For those with no sign, no assessment was possible.

Table 19: Elements of industrial competitiveness addressed by policies

	Institutions	Infrastructure	Macro-economic environment	Health	Education and training	Market efficiency	Labour market efficiency	Financial market development	Technological readiness	Market size	Business sophistication	Ability to innovate
Transport	See transport modes											
Rail	X	X		X	X	X			X	X		X
Road		X		X	X				X			X
Waterborne		X		X	X				X	X		X
Air		X		X	X	X			X	X		X
Environment				X		X			X			X
Security		X		X								
Industrial Competitiveness	*See different policy areas*											
Competition								X				
Internal Market						X						
Economic and Financial affairs			X									
External Trade												
CSR											X	
Research and Innovation					X				X			X
Motor industry									X			X
Shipbuilding					X				X			X
Aeronautic industry									X			X
Space industry									X			X
Tourism												
Social and consumer protection				X	X							
Energy		X				X			X	X		X

Table 20: Impacts of policies on the key elements of industrial competitiveness

Industries	Institutions	Infrastructure	Macroeconomic environment	Health	Education and training	Market efficiency	Labour market efficiency	Financial market development	Technological readiness	Market size	Business sophistication	Ability to innovate
Rail												
Rail equipment supply and manufacturing	-								+			
Rail freight services	-	+		+	+	-		+	+	+		+
Rail passenger services	-	+		+	+	-		+	+	-		+
Road												
Road haulage				+	+					+		
Light and commercial vehicles manufacturing				+	+	-		+	+			+
Air												
Aircraft manufacturing						+			+	+		+
Air passenger services		-		+	+	+			-			
Waterborne												
Short sea shipping		-								-		
Shipbuilding								+	+	+		+
Maritime global services		-			-							

10.5 Conclusions

The literature reviewed indicates that different policies may induce quite different impacts on particular transport modes and/or the entire industry sectors. The ultimate results depend on 1) how they interact with other policies enforced in parallel and/or in sequential manner, but also on 2) what measures the targets have themselves mobilised either to facilitate the policy objective, to oppose them or delay the impacts sought, or for any other internal reasons.

The modal shift from road to rail pursued by the environmental protection and transport policies may negatively affect road haulage and private vehicle manufacturing industry if considerable amounts of freight shift to railways and IWW but also if/when public transport and railways manage to attract considerably more passengers and reduce demand for motorised travel. One may surmise that since the transport and industrial policies also aim to enhance the global competitiveness of European automotive and aircraft manufacturing industries the attainment of the transport and environmental legislations is delayed. Balancing of these seemingly contradictory objectives requires quite a long-term perspective. However, it has also been observed that some environmental energy policy tasks such as improved energy efficiency and higher usage of alternative (and cleaner) energy sources in transport are instrumental for furthering both the environmental and the competitiveness objectives. And the other way round, the GHG emissions might not be reduced even if all goods are shifted from roads to railways and IWW when the later do not adopt the pollution reducing technologies while the commercial road vehicles become much cleaner.

Using the global competitiveness perspective one may think that the policies that directly or indirectly enhance user confidence in sustainability and safety of transport solutions are mainly relevant for the global transport services such as airlines and maritime operators because neither railways nor the IWW compete internationally. However, by attracting passengers to regional rail, coach or IWW services, the European companies may divert market shares from global aviation. By diversifying and innovating the supply options these service providers may become new players in competition for the global and/or pan-European travelers. As a consequence, this may stimulate demand for European IWW ships, buses and rail equipment from manufacturing industry.

Compliance with some policies especially those seeking to reduce environmental footprint of transport, enhancing transport safety and security, the workers social wellbeing and user rights are seen by some SMEs as cost inflating. So it is right of the EC to provide means that promote entrepreneurship and partly alleviate the policy adherence costs.

Compliance with any policies may induce some additional costs on the target industry. However, in the long-term the extra costs may give rise to an evolving competitive advantage as they did by fostering production of new vehicles and transport solutions for disabled people or more silent transport equipment. In addition, public policy may also trigger new R&D, which sometimes may contribute to development of lateral and/or new industry sectors.

Despite that, one shall not forget that issues related to security, international trade and

environmental protection which go beyond the national and European borders and need to be dealt with from global perspective. In such cases the role of EU policy is either to support implementation and enforcement of international standards through launching of an appropriate legislation or to negotiate with the extra EU governments on voluntary adoption of global standards.

We should also keep in mind that "competitiveness" is a relative construct which could be assessed from a comparative perspective only. Since a given company's competitiveness depends on how much pressure it can withstand from its rivals from the same and/or complementing industries, it means that competitiveness of the European transport industry should be measured against the impacts that other countries' policies invoke on their respective transport industries. Otherwise we know very little on the real global competitive position. An example illustrating deficiencies in the present assessment is provided here; the positive impacts of the European policies seeking changes in users' and consumers' behavior towards more sustainable transport modes will also depend on whether such behavioural changes are promoted overseas and whether they create market demand for the European transport equipment manufacturers and service providers.

However, the scope of this deliverable was neither to establish a comparative advantage with regards to other regions nor assessing impacts of international agreements, but to give an overview of the impacts that the European policies may exert on competitiveness of the European transport industry. Nevertheless these two issues may be considered for the future policy impacts assessments.

11. Annex

11.1 RACE2050 basics

Project acronym	RACE2050
Project title	Responsible innovation Agenda for Competitive European transport industries up to 2050
Call identifier	FP7-TPT-2012-RTD-1 [Prospects for transport evolution: challenges for the competitiveness of the European transport sector in the long term]
Grant Agreement no.	314753
Starting date	01/09/2012
End date	28/02/2015
Funding Scheme	Coordination and support action

RACE2050 consortium partners are:

Partner acronym	Partner name	Logo
TUB	TU Berlin, Zentrum Technik und Gesellschaft, Berlin, Germany	
RCAB	Ritchey Consulting AB, Stockholm, Sweden	
ZHAW	Zurcher Hochschule für Angewandte Wissenschaften, Zurich, Switzerland	
ICTAF	Interdisciplinary Center for Technological Analysis and Forecasting, Tel Aviv, Israel	
TOI	Transportokonomist Institutt, Oslo, Norway	
VTM	VTM Consultores em Engenharia e Planeamento Lda, Lisbon, Portugal	

11.2 Deliverable basics

Deliverable no.	D 3.1
Document name	RACE2050D3.1 DRAFT
Deliverable name	Impacts of European Policies on Global Competitiveness of the European Transport Industry
Work Package	WP3
Nature	Research
Dissemination	PUBLIC
Editor	Johanna Ludvigsen
Contributors	Iratxe Landa Mata, Yoel Raban, Andreas Christ, and Monica Oliveira
Due date of submission	September 30th 2013

11.3 Abbreviations

ACE	ATM Cost-Efectiveness
ACEA	European Automobile Manufacturers' Association
AEA	Association of European Airlines
ALICE	Alliance for Logistics Innovation through collaboration in Europe
ANS	Air Navigation Services
ARTEMIS	Advanced Research and Technology for Embedded Intelligence and Systems
ASM	Air Space Management
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATS	Air Transport System
CAA	Common Aviation Area
CAEs	Government institutions and public sector organisations
CBA	Cost Benefit Analysis
CCS	Capture and Storage
CEF	Connecting Europe Facility
CER	Community of European Railway
CFD	Computational Fluid Dynamics
CH4	Methane
CIS	Commonwealth of Independent States
CNS	Communications, Navigation, Surveillance
CO2	Carbon Dioxide
COC	Crews of Convenience
COM	Communication
Council	Council of the European Union
CSI	Common Safety Indicators
CSJU	Clean Sky Joint Undertaking
CSR	Corporate Social Responsibility
CST	Common Safety Targets
DG	Directorate General
EAC	Executive Agency for Competitiveness & Innovation
EAP	European Environmental Action Plan
EASA	European Aviation Safety Agency
EATMN	European Air Traffic Management Network
EBTP	European Biofuel Technology Platform
EC	European Commission
ECAC	European Civil Aviation Conference
ECDIS	Electronic Chart Display and Information System
ECSC	European Coal and Steel Community
EEA	European Economic Area

EEDI	Energy Efficient Design Index
EEPR	European Energy Programmed for Recovery
EES	Electrical and Electronic system
EFFRA	European Factories of the Future Research Association
EFTA	European Free Trade Association
EGNOS	European Geostationary Navigation Overlay Service
EIB	European Investment Bank
EIT	European Institute for Innovation and Technology
ELV	End-of-Life Vehicles
END	Environmental Noise Directive
ENIAC	European Nanoelectronics Initiative Advisory Council
EP	European Parliament
EPoSS	European Technology Platform on Smart Systems Integration
ERA	European Research Agency
ERA-NET	European Research Area Net
ERMTS	European Rail Traffic Management System
ERRAC	European Rail Research Advisory Council
ERSG	European RPAS Steering Group
ERTRAC	European Road Transport Research Advisory Council
ESC	European Shippers' Council
ESTEP	European Steel Technology Platform
ESTP	European Space Technology Platform
ETCS	European Train Control System
ETP	European Technology Platform; Executive Training Programme
ETS	Emissions Trading Scheme
EU	European Union
EUACA	European Union Airport Coordinators Association
EUMat	Advanced Engineering Materials and Technologies
EUROP	European Robotics Technology Platform
FAA	Federal Aviation Administration
FAB	Functional Airspace Blocks
FCH JU	Fuel Cells and Hydrogen Joint Undertaking
FDI	Foreign Direct Investment
FEU	Foot equivalent unit
FFP	Frequent Flyer Programme
FOC	Flags of convenience
FP	Framework Research Programmes
FPGA	Field programmable gate array
FTA	Free Trade Agreement
GDP	Gross Domestic Product
GHG	Greenhouse gases
GLONASS	Global Navigation Satellite System
GMES	Global Monitoring for Environment and Security
GMS-R	Global System for Mobile Communications – Railway

GNNS	Global Navigation Satellite System
GP	Gateway Programme
GPP	Green Public Procurement
GPS	Global Positioning System
HDV	Heavy-Duty Vehicle
HFC	Hydro-Fluorocarbons
HLG	High Level Group
HOT	High-Occupancy Toll
HSR	High Speed Railways
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICS	International Chamber of Shipping
ICT	Information and Communications Technology
IDIS	International Dismantling Information System
IEE	Intelligent Energy-Europe
IHCP	Institute for Health and Consumer Protection
ILS	Instrument Landing System
IM	Infrastructure Managers
IMO	International Maritime Organization
IMP	Integrated Maritime Policy
IPA	investment promotion agencies
IPR	Intelectual Property Rights
ISC	Integrated Simulation Centre
ISI	Integral Satcom Initiative Technology Platform
ISPS	International Ship and Port Facility Security
ITD	Integrated Technology Demonstrators
ITF	International Transport Forum
ITS	Intelligent Transport Systems
IWT	Inland Water Transport
IWW	Inland waterways
JAA	Joint Aviation Authorities
JRC	Joint Research Centre
JTI	Joint Technology Initiative
JTU	Joint Technology Undertakings
JU	Joint Undertaking
KET	Key Enabling Technologies
KPI	Key Performance Indicators
LCC	Low Cost Carrier
LLI	Life Long Learning
LPV	Localizer Performance with Vertical guidance
LRIT	Long range Tracking and Identification system
MEDA	Mediterranean Countries
MEGC	Multiple-element Gas Container
MERCOSUR	Mercado Comun del Cono Sur

MLC	Maritime Labour Convention
MNE	Multinational Enterprises
MoC	Memorandum of Cooperation
MoS	Motorways of Seas
MS	Member State
N2O	Nitrous Oxide
NESSI	Networked European Software and Services Initiative
NGO	Non-Governmental Organization
NSA	National Safety Authority
OCS	Online Coordination System
OECD	Organisation for Economic Co-operation and Development
OMC	Open Method of Coordination
PCM	Price Cost-Margin
PFC	Perfluorocarbons
PPP	Public Private Partnership
PPPI	Public Procurement Promoting Innovation
RCA	Relative Comparative Advantage
RDS-TMC/GSM	Radio Data System-Traffic Message Channel
RES	Renewable Energy Sources
RFID	Radio-Frequency identification
RIS	River Information Services
RPAS	Remotely Piloted Aircraft Systems
RSFF	Risk Sharing Financial Facility
RTTI	Run-Time Type Information
SAR	Search and Rescue
SEEMP	Energy Efficiency Management Plan
SES	Single European Sky
SESAR	Single European Sky ATM Research
SF6	Sulphur Hexafluoride
SGEI	Services of General Economic Interest
SME	Small and Medium Enterprises
SMS	Safety Management Systems
SOLAS	Safety of Life at Sea Convention
SRA	Strategic Research Agenda
SRPP	Socially Responsible Public Procurement
SSN	Community Vessel Traffic Monitoring System
SSS	Short Sea Shipping
STTP	Strategic Transport Technology Plan
TEN-T	Trans-European Transport Network
TEU	Twenty-foot equivalent unit
TFEU	Treaty on the Functioning of the European Union
TPEG	Transport Protocol Experts Group
TRKC	Transport Research Knowledge Centre

TS	Technical Specification
TSI	Technical Specification Indicator
TTI	Traffic and Travel information
UIC	Union of Railways
UIP	International Union of Private Wagon Owners
UITP	International Association of Public Transport
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIFE	Union of European Railway Industries
V2I	Vehicle to Infrastructure
V2V	Vehicle to Vehicle
VAT	Value Added Tax
VMT	Vehicles-Miles-Travelled
VPP	Value Pricing Program
VTIMS	Vessel Traffic Information Management System
VTS	Vessel Traffic Services
WCED	United Nations World Commission on Environment and Development
WHO	World Health Organization's
WP	Work Package
WTO	World Trade Organization
ZEP	Zero Emission Fossil Fuel Power Plants

11.4 List of figures

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