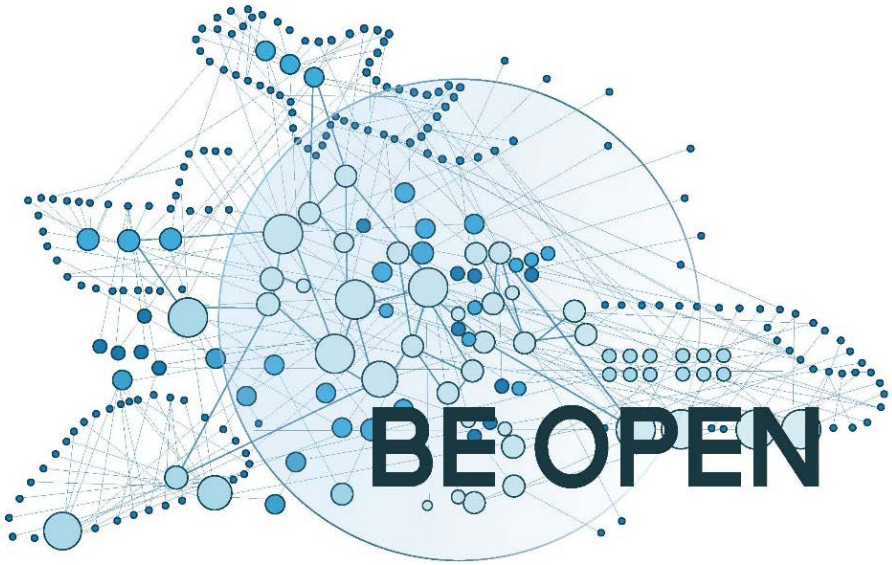
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824323



European forum and oBsErvatory for OPEN science in transport

Project Acronym:	**BE OPEN**
Project Title:	**European forum and oBsErvatory for OPEN science in transport**
Project Number:	**824323**
Topic:	**MG-4-2-2018 – Building Open Science platforms in transport research**
Type of Action:	**Coordination and support action (CSA)**

D1.1 Taxonomy of actors, terminology and experimental tools

Final

Deliverable Title:	D1.1 Taxonomy of actors, terminology and experimental tools
Work Package:	WP1: Focused objectives of key actors
Due Date:	M5 (extended for M6)
Submission Date:	30/06/2019
Start Date of Project:	01/01/2019
Duration of Project:	30 months
Organisation Responsible of Deliverable:	FIT Consulting srl (FIT)
Version:	1.1
Status:	Final
Author name(s):	Michela Fioretto (FIT) Afroditi Anagnostopoulou (CERTH)
Reviewer(s):	-
Nature:	☒ R – Report ☐ P – Prototype ☐ D – Demonstrator ☐ O - Other
Dissemination level:	☒ PU - Public ☐ CO - Confidential, only for members of the consortium (including the Commission) ☐ RE - Restricted to a group specified by the consortium (including the Commission Services)

Document history			
Version	**Date**	**Modified by (author/partner)**	**Comments**
0.1	02/05/2019	Michela Fioretto (FIT)	Table of contents
0.2	15/05/2019	Michela Fioretto (FIT)	First contents layout
0.3	27/05/2019	Celestino Sánchez (EURNEX) Charalampos Sergiou (EATEO) Lucile Mendoza (HUMANIST) Anna Walek (GUT) Ioannis Ergas (WEGEMT) Adewole Adesiyun (FEHRL)	Scientific sources contributions from partners
0.4	10/06/2019	Afroditi Anagnostopoulou (CERTH)	Comments and contributions to first chapters
1.0	11/06/2019	Michela Fioretto (FIT)	Development of final draft
1.1	30/06/2019	Michela Fioretto (FiT)	Final version

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Abbreviations and Terminology

ACARE	Advisory Council for Aviation Research and Innovation in Europe
ALICE	Alliance for Logistics Innovation through Collaboration in Europe
ATC	Air traffic control
CIV	International Convention for the transportation of Passengers
CORDIS	Community Research and Development Information Service
COTS	Commercial Off-the-Shelf component
E&T	Engineering and technology
EASA	European Authority in aviation safety
EATEO	European Association of Aviation Training and Educational Organisations
EC	European Commission
ECAC	European Civil Aviation Conference
ECSS	European Cooperation for Space Standardisation
ECTRI	European Research Association For Sustainable & Multimodal Mobility
EIRAC	European Intermodal Research Advisory Council
ERANET	European Research Area Network
ERRAC	European Rail Research Advisory Council
ERTRAC	European Road Transport Research Advisory Council
ESA	European Space Agency
ESTP	European Space Technology Platform
ETCS	European Train Control System
ETP	European Technology Platform
EU	European Union
EURNEX	European rail Research Network of Excellence
FP5	Fifth Framework Programme
FP6	Sixth Framework Programme
FP7	Seventh Framework Programme

GHG	Greenhouse gases
GNSS	Global navigation satellite system
H2020	Eighth Framework Programme
ICAO	International Civil Aviation Organization
IoT	Internet of Things
IT	Information technology
ITS	Intelligent Transport Systems
LCC	Life cycle cost
LIDAR	Laser Imaging Detection and Ranging
LTE	Long term evolution standards
NGOs	Non-Governmental Organisations
P2Ps	Public-public partnerships
PPPs	Public-private partnerships
R&D	Research and development
T2G	Train to ground
T2T	Train to train
TRIMIS	Transport Research and Innovation Monitoring and Information System
TSIs	Technical Specifications for Interoperability standards
UAV	Unmanned aerial vehicle
UIC	International Union of Railways
UITP	International Association of Public Transport
ULD	Unit load device
UNIFE	Association of the European Rail Industry
V2I	Vehicle to infrastructure
V2V	Vehicle to vehicle
WEGEMT	European Association of Universities in Marine Technology
WoS	Web of Science
WP	Work package

Executive summary

This document has been conceived to give an overview of the main actors involved in the transport sector by considering six main areas of competence to cluster the main findings, namely 1. Business Modelling, 2. Environmental, 3. Legal/Regulatory, 4. Socio-economic, 5. Technological, and 6. Transport planning.

The research of scientific sources has examined three different types of resources, in particular:

- Original research data;
- Operational data directly related to research;
- Data from published transport research.

The sources investigation made also use of a set of defined competence area keywords to allow a shared process for scientific sources search. Moreover, to perceive the evolvement of scientific production in the transport domain, the EU programmes of the last decades have been considered (i.e. FP5, FP6, FP7 and H2020).

Then, by selecting the main groups within the transport domain that can affect or are affected by the subject matter, project, strategy or regulation the source explored is dealing with, a list of stakeholders has been defined, which includes: research centres and universities, researchers and students, private researchers, policy makers (regional, national and international level), transport networks, NGOs and community organizations, commercial transport and logistics industry players and citizens.

Each stakeholder category has then been analysed within each of the six competence areas in order to distinguish between the ones directly affected, either positively or negatively, by the topic/ project/ strategy/ regulation in question (i.e. the so-called primary stakeholders) and the ones only indirectly affected (i.e. secondary stakeholders). This analysis has been performed by considering each type of data source investigated so to consider any possible differences among the same competence area.

This investigation has then been complemented by an analysis of three main actors' categories: industry, research and public authorities. To do that, for industry the main technology platforms and their strategies and declarations have been considered; for research the major influential research organisations and their research trends and main topic of interest, while for public authorities the ERANET initiative and TRIMIS and CORDIS tools.

The assessment showed the following:

- Concerning the **business modelling area**, policy makers, public authorities, transport networks and commercial and logistics transport players resulted to be the most influencing actors having interest and power to support research questions of scientific research. The same interest, but with lower influencing power, is owned by research centres and universities. Moreover, the evolution of scientific production

and related research questions is characterised by a focus that has passed from solving problems such as increased traffic demand, transport efficiency and modal shift towards a growing interest for innovative commercial models also using digital technologies and fostering seamless and shared mobility together with value creation with a focus on cross-cutting issues, user needs and people and goods services integration.

- Research centres and universities, public authorities, commercial transport and logistics industry players and policy makers resulted to have the highest interest and influence within the **environmental area**, followed by NGOs and community organisations together with citizens, for which the theme is relevant even if they do not have much influence on it. On the other side, transport networks seemed to be less interested in environmental topics even if they potentially have power on them. The evolution of scientific production and related research questions sees an increasing interest for ecological and green aspect of transport. Research questions have in fact gone from a more generic approach to tackle urban pollution and improve quality of life to a more committed engagement on environmental protection and monitoring, blue growth development, alternative energies and propulsions also in light of zero emissions targets, better understanding of the impact of land use and increase re-use and recycling.

- The main actors' groups influencing **transport legal and regulatory aspects** resulted to be both policy makers and public authorities, with the participation of transport networks and commercial and logistics industry players. Research centres and universities together with researchers and students, on the other hand, have little influence on legal and regulatory matters. The progression of scientific production and related research questions is depicted by a course started from the management of barriers and legal issues together with addressing incentives to arrive at analysing more in depth policy and regulatory needs, intermodal technical interoperability, regulatory frameworks allowing for a global level playing field for Europe to compete in the global market, policies for information and data sharing and ownership, PPPs and P2Ps, and a unified language for European transport operations.

- Many actors resulted to be both interested and influencing when considering the **socio-economic area**. In particular, public authorities, commercial transport and logistics industry players and transport network appear to be the main players in the field followed by research centres and universities. On the contrary, transport networks seemed to have no particular interest in such an area. The tendency of scientific production and related research questions show a transition from topics and issues related to safety, social and economic constrains, public participation and improvement of collective transport for better accessibility and social inclusion to user awareness, market liberalisation, circular economy in transport, investments in EU innovations and transport capacity, supply chain cost reduction, travel behaviour, ageing society, pricing and externalities and service economics.

- The main interest and influence within the **technological area** is showed by research centres and universities together with commercial transport and logistics industry players followed by transport network and policy makers, while the role of public authorities is mainly linked to operational data gathered within this area. Quality of transport system and services together with traffic congestion related issues and the advancement of critical technologies constitute the starting point for the evolution of scientific production and related research questions. During decades topics evolved towards themes dealing with smart and connected transport, services provision from hub to hub, digital awareness and resilience, automated vehicles, big data, IoT and blockchain, physical security, new space-based applications, cooperative systems, new materials, augmented reality systems and smart grids and sensors.

- Public authorities, transport networks and policy makers represent the actors' categories with most relevant interest and influence when dealing with the **transport planning area** followed by commercial transport and logistics industry players and research centres and universities. The development of scientific production and related research questions showed to have its foundation on topics and issues mainly dealing with traffic congestion, emissions reduction and safety increase. Then, the evolution that has characterised the last decades until today has seen a change towards challenges regarding accessibility, smart city planning, network efficiency, interoperability within modes, integrated and resilient transport systems and risk analysis and management.

1 Introduction

1.1 Purpose of the document

The main purpose of this document is to give an overview of the main actors involved in the transport sector by considering six main areas of competence to cluster the main findings. Provided that a search strategy is usually quite broad, attempts have been made to follow the most practical way to achieve good results. To this aim, the search strategy resulted to be a crucial point for not scattering efforts and get an understanding of the evolution of scientific work in the transport domain.

2 The approach

As a first step for promoting Open Science in transport research, within WP1 a classification of key actors in the transport domain has been derived. Hence different stakeholders involved in transport sector have been identified and a review of scientific sources search have been carried out for recognising how scientific production and related research questions have been progressed along during the last decades.

An important perspective is based on future use cases for all transport modes (road, rail, air, water, cross-modal) affecting trends and related industrial developments in the transport arena. Towards this direction, a systematic review of current scientific production of all transport modes by assessing activity of current European technology platforms (i.e. ERTRAC, ERRAC, WATERBORNE ETP, EIRAC, ACARE, ESTP, ALICE) in an attempt to cover the industry needs, and main influential organizations (such as ECTRI, EURNEX, EATEO, WEGEMT) could provide an overall assessment of research scientific production against innovation uptakes. Moreover, national initiatives and actions could also foster an evidence-based discussion and cross-fertilization of ideas amongst countries acting as an evidence-based, community driven sharing of knowledge and experiences. In other words, a) Technology Platforms, b) Influential research organizations and c) National initiatives and actions could set the basis of the systematic taxonomy of key actors (Figure 1) in order to provide a unified transport terminology and related research and investigation instruments in each of the 6 competence areas: 1. Business Modelling, 2. Environmental, 3. Legal/Regulatory, 4. Socio-economic, 5. Technological, and 6. Transport planning with the aim to identify competences, problems, research needs and questions, and future scenarios. As such, relevant recommendations for the definition of future Open Science services and infrastructures will be delivered in an attempt to support operationalizing Open Science in transport research of the European area.

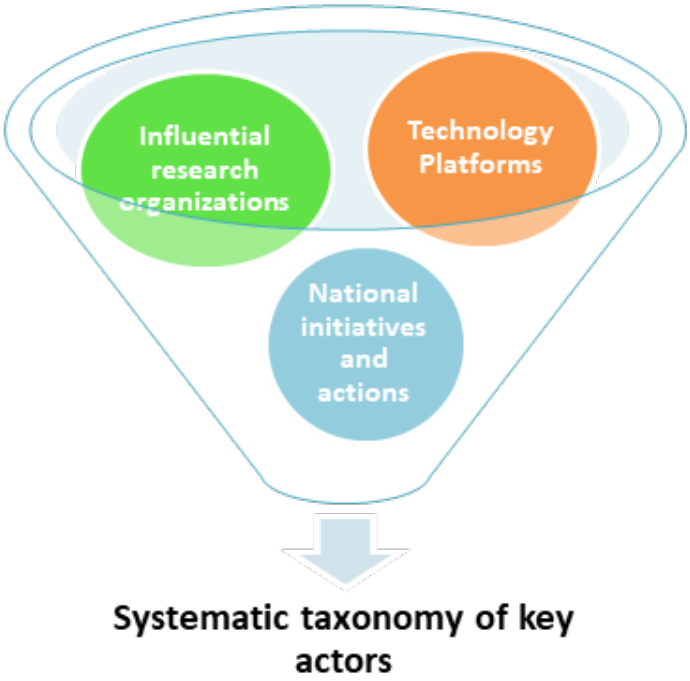

Figure 1: BE OPEN main sources for systematic review of current scientific production

The results coming from both the scientific sources review and the analysis of strategies, position papers and declarations of the main actors represent the foundations upon which an overall assessment by area of competence allows to understand the evolution of scientific production and related research questions, deduct the main actors involved and derive a common transport terminology and related research and investigation instruments.

3 Review of scientific sources

3.1 Literature search methodology

As defined by Merriam-Webster dictionary, a literature search is a "*methodological investigation of all published sources for information bearing on a usually scientific or technological subject*." So in principle, a literature search is not just a single search, but rather a sequence of searches being carried out across all possible resources. The ultimate result of such as search is then a list of resources that have been detected as pertinent to the subject matter and that provide information on it. For this reason, a literature search distinguishes from an informational or reference search, which is rather an investigation on simple facts or data. Hence, for a researcher the outcomes of a literature search will be supportive for understanding both the scope and the extensiveness of literature on a specific topic, as well as the possible utility of certain works.

In the light of the above, it can be stated that there is no perfect literature search. Nonetheless, during every search the main aim is to maximise both the efficiency of the process and the benefits arising from it. Therefore, searching is a sort of interactive activity

that tries to gather relevant materials, merge and refine overall results and articulate results to add value.

Another key point is that a complete literature search can and should encompasses different resources, including Internet search engines, databases, and library catalogues. Each of them has their own peculiarities as illustrated in Table 1.

Table 1: Distinctive futures of literature search possible resources [Source: "Literature Searches and Literature Reviews for Transportation Research Projects", Transportation Research Board, March 2015]

Type of resource	Main peculiarities
Internet search engines	✓ Cover all subjects; ✓ Are free; ✓ Retrieve many results; ✓ Are useful for finding grey literature; ✓ Include full text of some literature; ✓ Offer no guarantee that the information will remain unchanged or still be available in the future; ✓ Provide no quality control of the information found.
Databases	✓ Provide a level of quality control to their content; ✓ Cover information on a specific subject area; ✓ Are sometimes subscription based, which limits access; ✓ Are useful for locating academic literature.
Library Catalogues	✓ List library holdings, either for an individual library or many libraries; ✓ Include monographs and theses; ✓ Are free, but may be limited to specific audiences; ✓ Rarely include full text of materials; and ✓ Typically exclude individual journal or conference papers.

Hence, with the aim to set the necessary context of the current and future scientific production and understand the progress over time of transport research main topics in BE OPEN different resources have been used, in particular:

- Original research data: data from research results and research models from published works, also including data from field operational tests;
- Operational data directly related to research: data mainly from publicly available datasets, which can include for example data on traffic accidents, public transport and road lengths;
- Data from published transport research: data from transport research related publications in scientific journals or delivered at conferences, workshops, etc.

Within each of the above categories, a number of public and private sources has been specified to narrow the research focus, as illustrated in Table 2.

Table 2: Sources utilised for each type of data investigated

Type of data	Type of resource used in BE OPEN	Short description

Type of data	Type of resource used in BE OPEN	Short description
Original research data	*EC funded projects*	Projects developed with the financial support of the EC and focused on main transport challenges.
	Industry and research projects and initiatives	Projects and activities promoted by both industries and research bodies means focused on planned research or critical investigation to acquire new knowledge and skills for developing new products, processes or services or for bringing about significant improvement in existing products, processes or services.
	Research activities libraries (e.g. TRIMIS, ERTICO Observatory, etc.)	Online information platforms with information and data on the European transport research and innovation systems and tools.
	University projects and initiatives	Initiatives and projects promoted by universities in the field of transport having the aim to encourage the development of transport and mobility concepts and research.
Operational data directly related to research	*National public authorities*	Dataset periodically collected by any government or other public administration, including public advisory bodies at national level.
	European public authorities	Dataset periodically collected by any government or other public administration, including public advisory bodies at European level.
	Other public authorities	Dataset periodically collected by any government or other public administration, including public advisory bodies at global or sectorial level.
Data from published transport research	*SCOPUS*	A database of peer-reviewed literature (e.g. scientific journals, books and conference proceedings) delivering a

Type of data	Type of resource used in BE OPEN	Short description
		comprehensive overview of the world's research output in the fields of science, technology, medicine, social sciences, and arts and humanities.
	WoS	An online subscription-based scientific citation indexing service that provides a comprehensive citation search by giving access to multiple databases that reference cross-disciplinary research.
	Google Scholar	A freely accessible web search engine that indexes the full text or metadata of scholarly literature across an array of publishing formats and disciplines.
	Other citation database of peer-reviewed literature	Additional databases and search engines useful in an academic setting for finding and accessing articles in academic journals, institutional repositories, archives, or other collections of scientific and other articles.

Like most literature searches also in BE OPEN the initial step has been to clearly define the main scope of the search, that is to perceive the evolvement of scientific production in the transport domain with the ultimate aim of recognizing the key actors of the sector. To this end, the EU programmes of the last decades have been taken into consideration by detecting the main subject matters and challenges each of them was seeking to tackle. In particular, the literature investigation has focused on the following funding programmes for research and technological development:

- Fifth Framework Programme (1998-2002);
- Sixth Framework Programme (2002-2006);
- Seventh Framework Programme (2007-2013);
- Horizon 2020 (2014-2020).

3.2 Scientific sources clustering

Scientific sources have then been bundled based on:

- Period of reference, by referring to the framework programme time frame; and
- Competence area.

Then, in terms of relevance of material and to follow a common procedure for literature selection, within each competence area and period of reference a set of keywords has been identified and used to guide the searches.

3.2.1 Competence areas and related keywords

BE OPEN has defined six areas of competence under which scientific sources have been grouped:

1. Legal/Regulatory area: progresses such as the concept of mobility as a service and driverless vehicles will transform citizens' lives and affect businesses' transport and logistics requirements. Also, if considering the maritime transport, international trade is becoming increasingly challenging. In such a quickly changing environment, regulations, action plans, policy instruments and incentives are a key aspect to be considered.
2. Technological area: in transport, this area is the one dealing mainly with new technologies and innovations applied to transport for technological improvements (e.g. new propulsion engines and new materials), better traffic management, increased security and safety and processes automation. So, for instance, for road transport it can be considered the use of ITS for coordinating traffic signals, giving signal priority to transit lanes, electronic information signs and variable speed limit signs, connected and autonomous vehicle technology, keyless fleet management and traffic analytics, on-road communications and wireless communications technologies applied to transportation infrastructure and vehicles (V2V, V2I).
3. Transport planning area: transport planning is strictly related to a sustainable transport vision in terms of any means of transport included walking and cycling for reducing the impact on the environment, the economy and society. Of course this applies also to freight transport in terms of planning a logistics system by anticipating the economic dynamics that determine the request for the transport of goods, making strategic decisions on the basis of these analyses for the development of an infrastructure network, while protecting social and environmental sustainability at the same time. Today this translates in favouring intermodal transport, through the optimisation of the integration between different infrastructural networks: waterways, railways, road connections.
4. Business modelling area: as in all fields, a business model is the description of means and methods a company applies to earn the revenues projected in its plans. Thus, also in the transport context innovative business models are growing and often can help take measures from pilot to full-service level. Some examples include Uber whose revenue model foresees a 5-20% commission on all the rides made through its service. Since all payments are done automatically through the app, Uber ensures to capture a part of the transaction; SFpark that makes money with providing parking spaces in San Francisco city-area. Parking prices are incrementally raised or lowered in SFpark areas based on demand; Flexport that is an end-to-end freight forwarder

managing imports and exports for clients that need to ship their products all over the world. They manage the entire process, from picking up goods at the manufacturer to dropping them off at distribution centres and warehouses.

5. Socio-economic area: in transport, this field covers a broad range of topics related to social and economic aspects by addressing issues related for example to accessibility, including the accessibility of transport to the mobility impaired and accessibility to basic services (health centres, shops, culture, etc.) for everyone; the financing of public transport and transport projects (including road infrastructure) generally and the socio-economic impacts that transport services have both locally and widely.
6. Environmental area: by considering that transport delivers substantial socioeconomic benefits, but, at the same time, it impacts environmental systems in terms of pollutants emission, traffic congestion, noise pollution, land consumption and damages together with externalities, greening transport is a crucial aspect to consider.

For each of the competence areas defined – as summarised in the table below (Table 3) – a set of *competence area keywords* has been outlined to allow a shared process for scientific sources search.

Table 3: Competence area keywords used for scientific searches

Competence area	Keywords	
Legal/Regulatory area keywords	✓ Transport regulation ✓ Policy instruments ✓ EU Directive ✓ Policy makers ✓ Legal barriers ✓ Regulatory barriers ✓ Regulatory framework	✓ Action plan ✓ Incentives ✓ Legal issues ✓ Roadmap ✓ Legal framework ✓ Transport governance
Technological area keywords	✓ ITS applications ✓ Infomobility ✓ Control systems ✓ Automated transport ✓ Autonomous vehicles ✓ Transhipment systems ✓ Hybrid vehicles	✓ Electric vehicles ✓ Propulsion systems ✓ Process automation ✓ Design of vehicles ✓ Lightweight ✓ Safety systems
Transport planning area keywords	✓ Transport plan ✓ Integrated urban plan ✓ Transport network ✓ Smart city planning ✓ Traffic engineering ✓ Urban studies ✓ Land use	✓ Urban simulation models ✓ Urban design ✓ City logistics ✓ Liveable city ✓ Accessibility ✓ Transport demand
Business modelling area keywords	✓ Business model for urban mobility ✓ Role-based business	✓ Value proposition ✓ Multi-actor business modelling

Competence area	Keywords	
	ecosystem ✓ Business process modelling ✓ Organisational structure ✓ Total cost of ownership ✓ Green business ✓ Transportation models	✓ Value creation ✓ Integrated business models ✓ Shared mobility ✓ Innovative solutions
Socio-economic area keywords	✓ Social innovation ✓ Social impacts ✓ Economic impact ✓ Cost Benefit Analysis ✓ Economic growth ✓ Productivity ✓ Economic development	✓ Social inclusion ✓ Cultural heritage ✓ Sustainable development ✓ Circular economy ✓ Social service ✓ Inclusive transport
Environmental area keywords	✓ Sustainable transport ✓ Emissions reduction ✓ Environmental Impact Assessment ✓ Carbon footprint ✓ Global warming ✓ Climate change ✓ Eco-driving	✓ Alternative fuels ✓ Congestion ✓ Noise pollution ✓ Environmental efficiency ✓ Sustainable urban systems ✓ Environmental performances

3.2.2 Research trend keywords

As mentioned above, the period of reference has been linked to the EC funding programmes as the main guidance to determine the trends followed by the scientific production and the related research questions over the last decades. In particular, the main objectives of the EC Framework Programmes in the transport domain have been translated into *research trend keywords* to be used during the scientific search.

The table below (Table 4) shows the list of the main keywords used split by EU Framework Programme. The evolution of such a programme – considered as the financial tool for EU research activities – reveals that during decades its main scope has been enlarged, the focus on pre-competitive research abandoned, and an approach based on addressing societal challenges and supporting a wider range of activities in the innovation process pursued. In this framework both Sixth and Seventh Framework Programmes have been designed to implement the EU research policy, which aimed to address the fragmentation of the

European research landscape. The subsequent adoption of the Europe 2020 strategy[1] and the Innovation Union flagship Initiative[2] in 2010 influenced the structure of Horizon 2020.

Table 4: Research trend keywords used for scientific searches for each EU transport Framework Programme

Fifth Framework Programme	Sixth Framework Programme	Seventh Framework Programme	Horizon 2020
✓ Information technology	✓ Interoperability	✓ Modal shift	✓ Resilient transport systems
✓ Urban pollution	✓ Environmental-friendly transport	✓ V2V - Vehicle to vehicle	✓ Automated Road Transport
✓ Urban congestion	✓ Vehicle efficiency	✓ Fully integrated management systems	✓ Electric vehicles
✓ Rational use of energy	✓ Competitive transport	✓ Emerging technologies	✓ Seamless mobility
✓ Effective transport management system	✓ Alternative fuels in public transport	✓ Co-modality	✓ Shared mobility for people and goods
✓ Urban environment	✓ Collective transport	✓ Intermodality	✓ Safety and security
✓ Growing of mobility demand	✓ Integration with other transport modes	✓ Vulnerable road users	✓ Zero fatalities
✓ Sustainable use of resources	✓ Innovative freight logistics services	✓ Mobility integration	✓ Innovative freight delivery systems
✓ Environmental constrains	✓ Clean vehicle fleets	✓ Automated urban vehicles	✓ Inclusive and affordable transport
✓ Safety constrains	✓ Dedicated infrastructure	✓ Green cars	✓ Robust transport systems
✓ Economic constrains	✓ Information services	✓ Emissions abatement	✓ Zero emissions
✓ Social constrains	✓ Intermodal travel information	✓ Eco-innovation	✓ Competitiveness
✓ Fatalities	✓ Vehicle location	✓ Innovation and competitiveness	✓ Forward-looking activities
✓ Increased efficiency	✓ Guidance and traffic management	✓ Private-public partnership	✓ Innovative powertrains

[1] http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf.
[2] https://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication-brochure_en.pdf.

Fifth Framework Programme	Sixth Framework Programme	Seventh Framework Programme	Horizon 2020
✓ Cooperation between manufacturers	✓ Transport pricing	✓ Job creation	✓ Dependence on fossil fuels
✓ Design integration	✓ Payment systems	✓ Public participation	✓ Mitigation of climate change
✓ System competitiveness	✓ Polluting transport	✓ Energy consumption reduction	✓ Adverse health effects
✓ Emissions reduction	✓ Accessibility	✓ Congestion reduction	✓ Air quality
✓ Noise reduction	✓ Security	✓ Increased use of public transport	✓ Personalised/smart services
✓ Employment	✓ Navigation services	✓ Advanced driver assistance systems	✓ Internet of Things
✓ Quality of life	✓ Timing services	✓ More efficient transport	✓ Blockchain
✓ Economic development	✓ Satellite communications	✓ More comfortable transport	✓ Resilient and responsive infrastructure
✓ Technological prospects	✓ Door-to-door transport	✓ Mobility services for people and goods	✓ New materials and processes
✓ SME specific schemes	✓ SME participation to new instruments	✓ Innovative forms of urban transport	✓ Interoperability of transport systems
✓ Quality of transport system and services	✓ Traveller services	✓ Alternative and cleaner fuels	✓ Common standards and procedures
✓ Development of critical technologies	✓ Renewable fuels	✓ Time-to-market decrease	✓ Demographic trends
✓ Increasing safety	✓ Rational use of motorised transport	✓ Navigation and control systems for optimised planning and routing	✓ Co-creation of novel integrated solutions
✓ Traffic congestion	✓ Clean maintenance	✓ Intelligent Transport Systems	✓ On-demand public transport
✓ Integrated deployment	✓ Increase capacity of infrastructure	✓ Personal Rapid Transit system (PRT)	✓ Multi-disciplinary collaborations
✓ FP5	✓ FP6	✓ FP7	✓ H2020

3.2.3 Stakeholders and their characterization

In the framework of scientific sources investigation, a preliminary list of stakeholders has been defined to be considered during the literature search. In particular, the following list (Table 5) has been composed by selecting the main groups that can affect or are affected by the subject matter, project, strategy or regulation the source explored is dealing with.

Table 5: Preliminary list of stakeholder

Preliminary list of stakeholder
✓ Research centres and Universities ✓ Researchers and students ✓ Private researchers ✓ Policy makers (regional, national and international level) ✓ Transport networks ✓ NGOs and community organizations ✓ Commercial transport and logistics industry players ✓ Citizens

As a second step, the stakeholders have been characterised by their relationship to the topic/ project/ strategy/ regulation in question by availing of the following categorisation:

- *Primary stakeholders:* people or groups that are directly affected, either positively or negatively, by the topic/ project/ strategy/ regulation in question.
- *Secondary stakeholders*: people or groups that are indirectly affected, either positively or negatively, by the topic/ project/ strategy/ regulation in question. Secondary stakeholders might include, for instance, residents who live near a bus station and are thus affected by the decision of the local public transport operator to decrease or enhance a certain bus line in terms of better or worse accessibility and liveability of the area.
- *Key stakeholders:* people or groups whose skills, knowledge or position of power can significantly influence a project or programme. They might belong to either or neither of primary or secondary stakeholders' groups and are those who have political responsibility (e.g. mayors, councillors, other authority levels), financial resources, authority (by domain or territory) or skills and expertise (e.g. public administrations, universities, private sector) in transport domain. Key stakeholders are then those actors without whose endorsement and engagement the targeted results of a project generally cannot be achieved.

For example, in deliveries and commercial vehicle operations, the primary stakeholders include vehicle owners and delivery services providers. Moreover, also enforcement bodies such as the police and vehicle examiners are primary stakeholders if considering regulations and enforcement on weights and permits. From the public policy perspective, local communities will also have an interest, although a secondary one such as in the case there is public concern about the potential impact of operations.

Finally, to prioritise which stakeholders are the most pivotal ones, it has also been used the *importance/Influence matrix* (Figure 2) developed by the World Bank[3]. This tool allows allocating each stakeholder group in the most appropriate position between the axes. In particular, the *importance* – along the x-axis – means the degree to which a stakeholder stands to lose or gain from the project; while the *influence* – along the y-axis – relates to the relative ability of a stakeholder to affect project success.

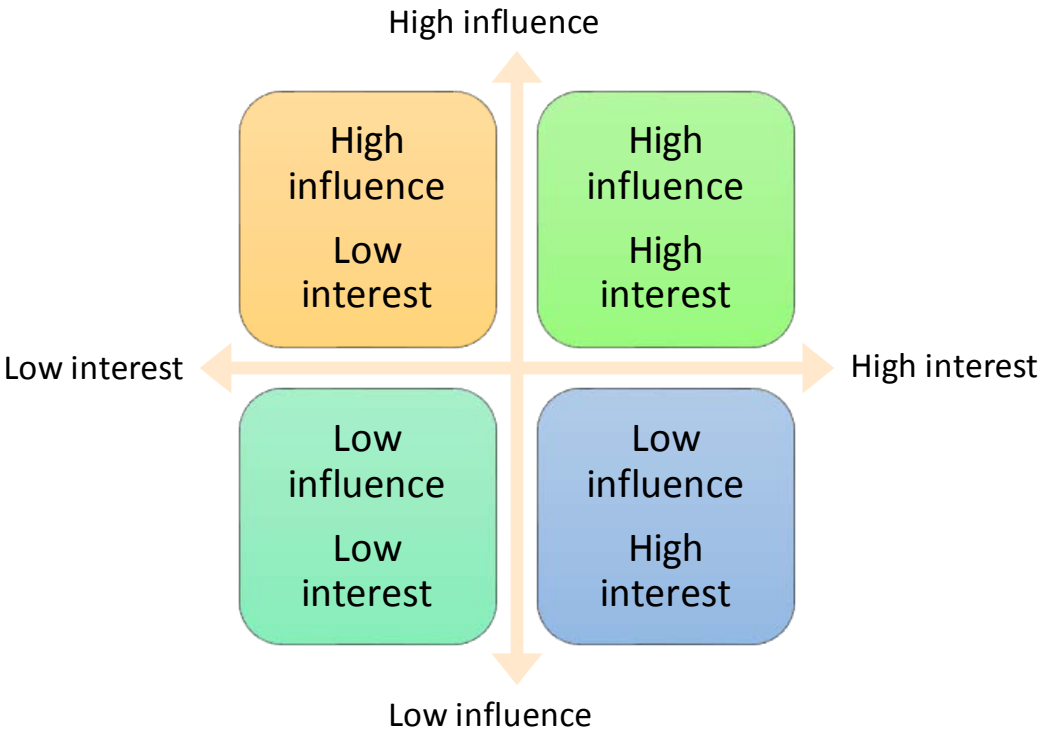

Figure 2: Importance/Influence matrix

The above matrix is then being used for dividing stakeholders into one of four groups, each occupying one space in the four-space grid. In particular, the line running from the bottom to the top of the grid represent the level of interest (from low to high), which can be translated either as being interested in the topic/ project/ strategy/ regulation or being affected by it. The line running from left to right represents instead the level of interest (from low to high) a certain group of stakeholders can show on a particular topic/ project/ strategy/ regulation.

Each quadrant bundles stakeholders with similar characteristics in terms of how they relate to the topic/ project/ strategy/ regulation, namely:

- In the upper right quadrant, there are the so-called *promoters*, which have both great interest and the power to support the topic/ project/ strategy/ regulation;

[3] "Stakeholder analysis and consultation", World Bank.

- In the lower right quadrant, there are the so-called *defenders*, which show interest in the topic/ project/ strategy/ regulation, but have little power to influence it;
- In the lower left quadrant, there are the so-called *apathetics*, which have both little interest and low influence and may not even be aware of the topic/ project/ strategy/ regulation;
- In the upper left quadrant, there are the so-called *latents*, which have no particular interest or involvement in the topic/ project/ strategy/ regulation but have the power to affect it if they become interested.

People considered as *key stakeholders* usually appear in the upper right quadrant.

3.3 Appraisal against the areas of competence

The scientific sources search has provided an interesting sample to be used as a starting point for a first assessment of the three different categories of research data.

If considering the breakdown by different Framework Programmes, the sample of 67 sources investigated for the original research data shows a prevalence of the FP7 (36%) followed by H2020 (27%) while the older programmes are equally represented.

Different is the case for operational data directly related to research where the sample of 53 sources is significantly skewed in favour of H2020 programme (64%) whereas FP7 and FP6 have slightly the same percentages (19% and 13% respectively); only a 4% is represented by operational data from FP5 time period.

A similar share was found in data from published transport research; in that case the sample of 696 sources has been characterised by a quite high share of H2020 data (57%) followed by FP7 with a percentage of 25%, FP6 and FP5 with 9% each.

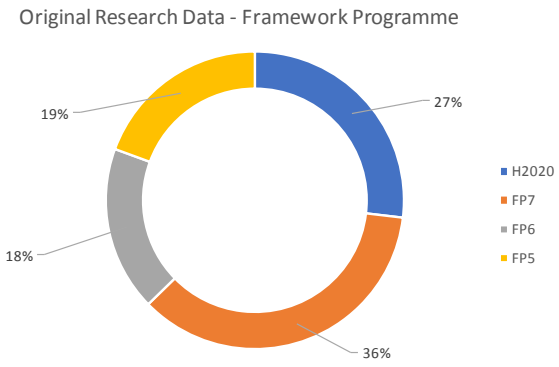

Figure 3: Framework Programmes for original research data

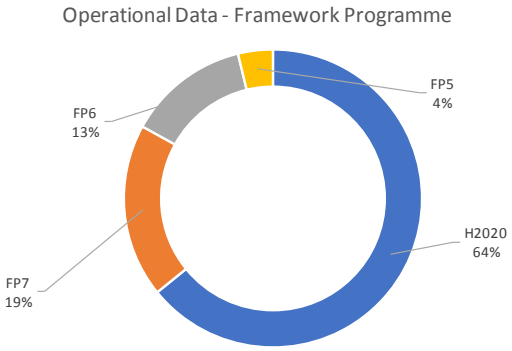

Figure 4: Framework Programmes for operational data directly related to research

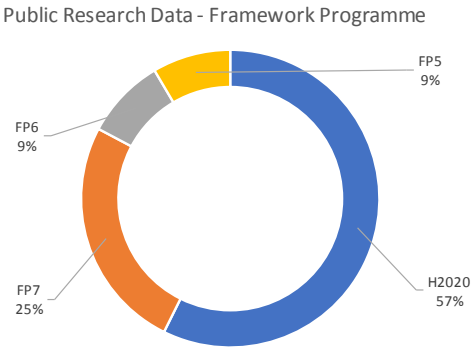

Figure 5: Framework Programmes for data from published transport research

As described in paragraph 3.1, for each category of data different sources could be used. In particular, for original research data the large majority derived from EC funded projects (96%), while the main type of source for operational data directly related to research has been the National public authorities (60%), followed by European public authorities (23%) and other public authorities (17%). Ultimately, WoS has been the main source for public research data with a percentage of 93%.

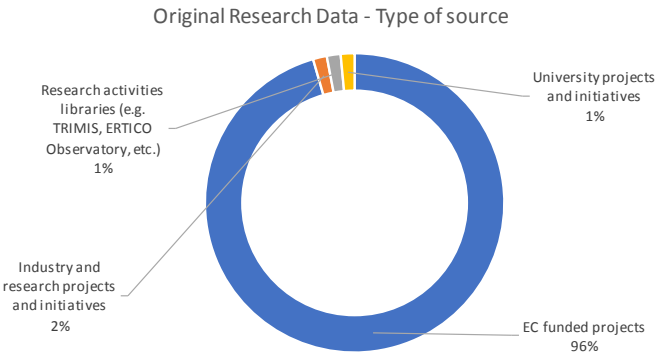

Figure 6: Type of source for original research data

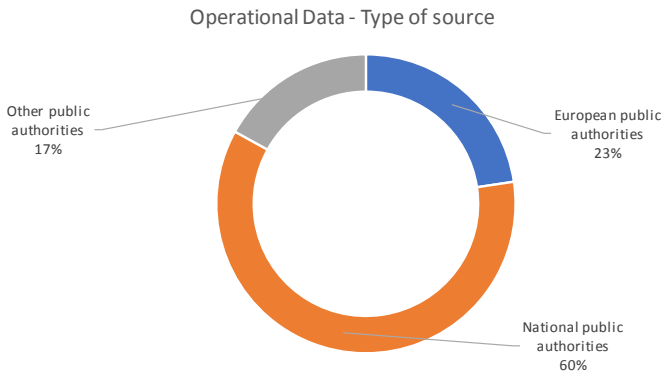

Figure 7: Type of source for operational data directly related to research

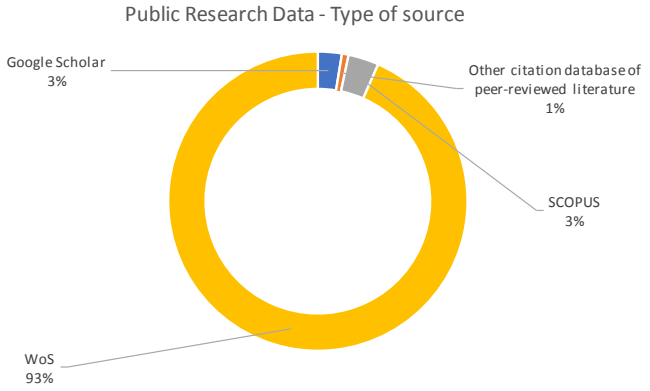

Figure 8: Type of source for data from published transport research

Regarding the distribution among the six different areas of competence, for the original research data the most represented area has been the technological one (54%) while the business modelling area constituted only the 4% of this source category.

The legal/regulatory area has been the most populated when considering the operational data directly related to research with a share of 51% followed by the transport planning area with 26%. Technological and environmental areas have been the less present with a percentage equal to 4% and 2% respectively.

In the case of data from published transport research, there has been a completely opposite situation with environmental and technological areas having the major shares with 33% and 24% respectively. Also, transport planning and socio-economic areas have been well represented with a share of 16% and 13%.

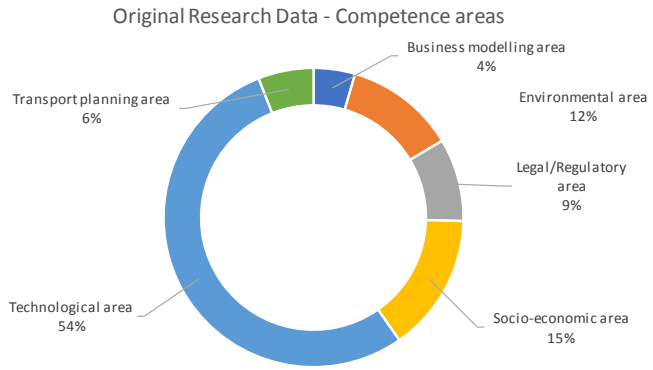

Figure 9: Competence areas for original research data

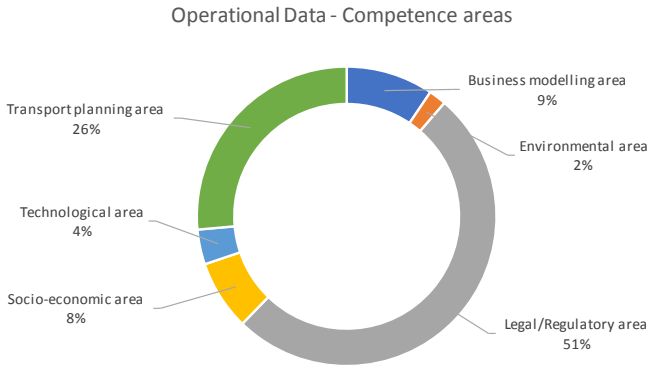

Figure 10: Competence areas for operational data directly related to research

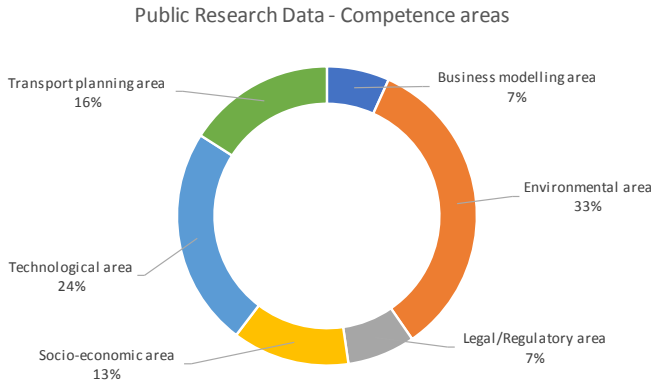

Figure 11: Competence areas for data from published transport research

3.3.1 Original research data

Going into details for each research data category, for each competence area the different allocation of primary, secondary and key stakeholders has been investigated.

In the business modelling area commercial transport and logistics industry players are the main primary stakeholders (43% of share) together with public authorities and transport networks.

A mirroring situation has been encountered also if considering key stakeholders.

Concerning secondary stakeholders, more categories have been represented with policy makers at international level having a share of 25%, while research centres and universities, policy makers at local, regional and national level, transport networks and citizens having a similar percentage (around 12%-13%).

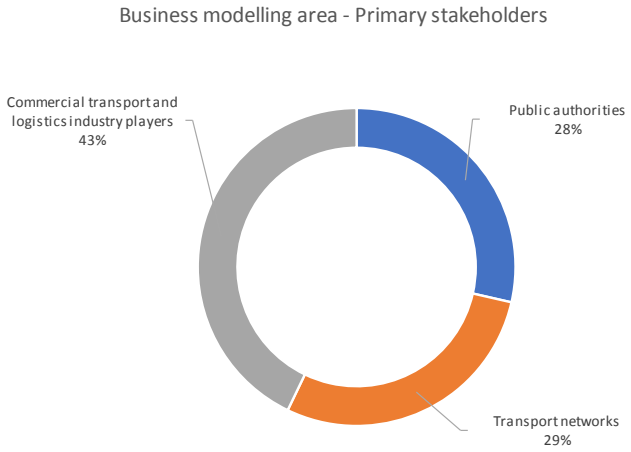

Figure 12: Primary stakeholders within business modelling area for original research data sources investigated

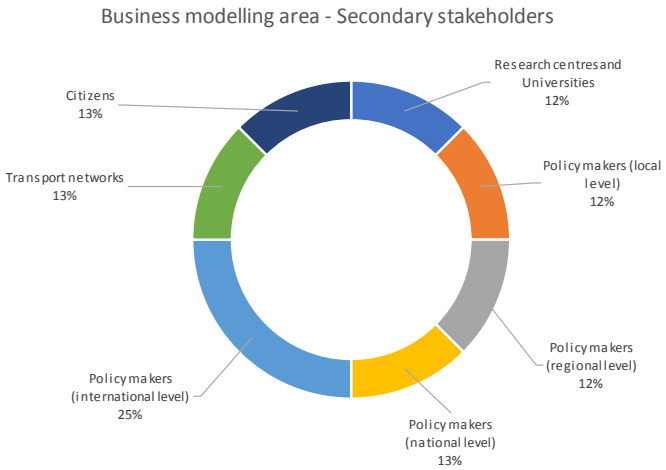

Figure 13: Secondary stakeholders within business modelling area for original research data sources investigated

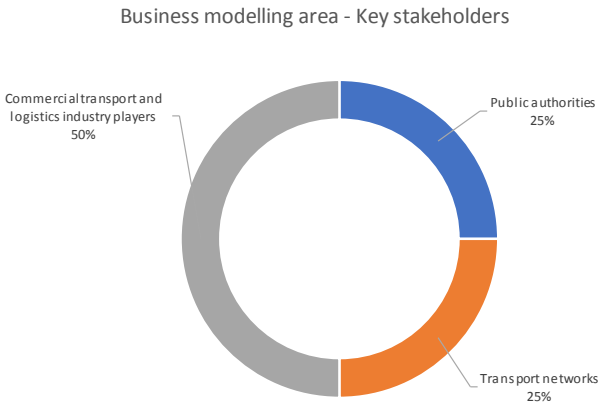

Figure 14: Key stakeholders within business modelling area for original research data sources investigated

The environmental area main primary stakeholders are represented by commercial transport and logistics industry players (33%) followed by research centres and universities and public authorities (17% each).

A slightly different situation has been encountered when considering key stakeholders; in that case commercial transport and logistics industry players had 50% of share while public authorities 25% and transport networks and research centres and universities having 13% and 12% respectively.

Secondary stakeholders have been mostly represented by citizens (50%).

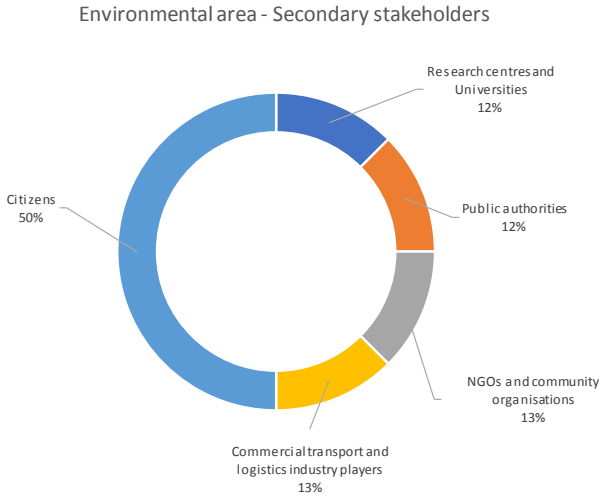

Figure 15: Primary stakeholders within environmental modelling area for original research data sources investigated

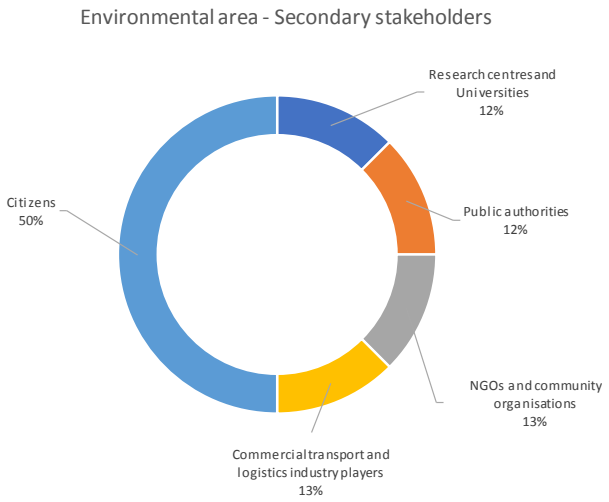

Figure 16: Secondary stakeholders within environmental modelling area for original research data sources investigated

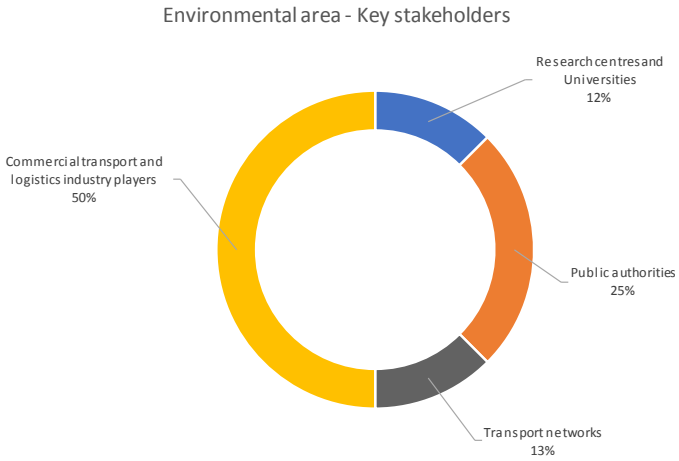

Figure 17: Key stakeholders within environmental modelling area for original research data sources investigated

Public authorities and commercial transport and logistics industry players are equally distributed as primary stakeholders for legal/regulatory area (29% each) followed by research centres and universities with a share off 14%.

A very different situation in case of key stakeholders where public authorities have a share of 71% and commercial transport and logistics industry players of 29%.

Finally, secondary stakeholders are represented by citizens for a 40% and by transport networks, policy makers at national level and research centres and universities with a 20% each.

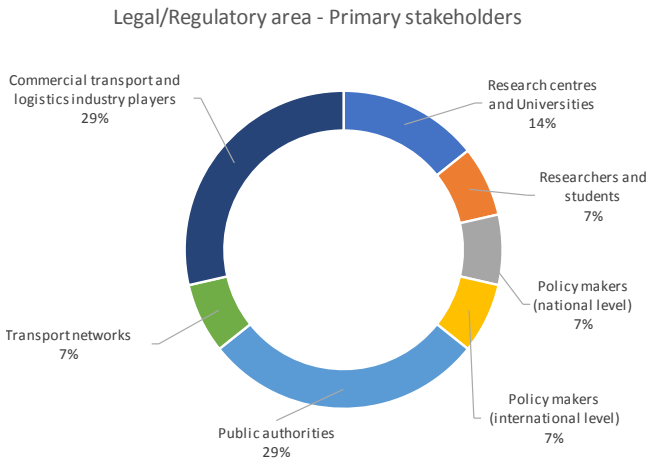

Figure 18: Primary stakeholders within legal/regulatory area for original research data sources investigated

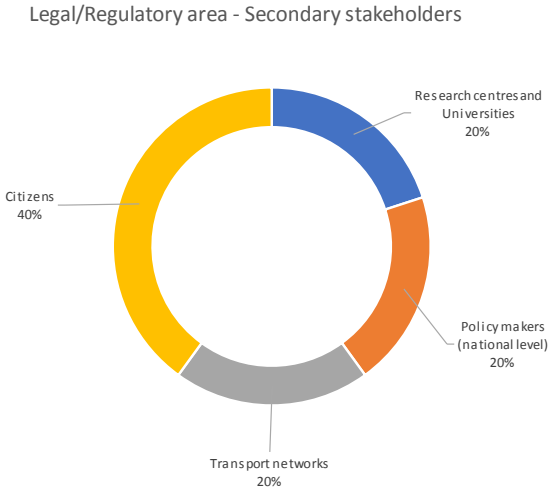

Figure 19: Secondary stakeholders within legal/regulatory area for original research data sources investigated

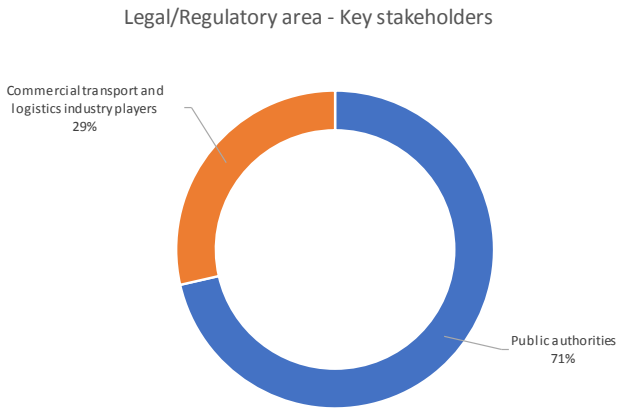

Figure 20: Key stakeholders within legal/regulatory area for original research data sources investigated

In the socio-economic area there have been identified many primary stakeholders mainly represented by commercial transport and logistics industry players with 29%, followed by transport networks and research centres and universities with 15% and 11% respectively.

A quite similar prospect can be seen also when considering key stakeholders.

Research centres and universities and transport networks belong also to secondary stakeholders with a share of 23% and 22% respectively.

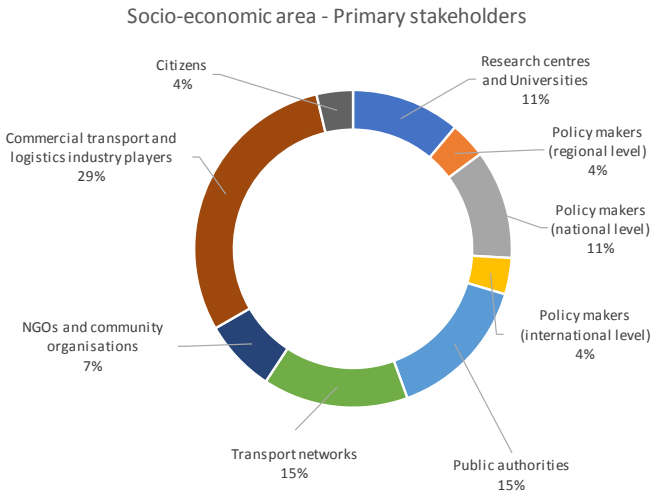

Figure 21: Primary stakeholders within socio-economic area for original research data sources investigated

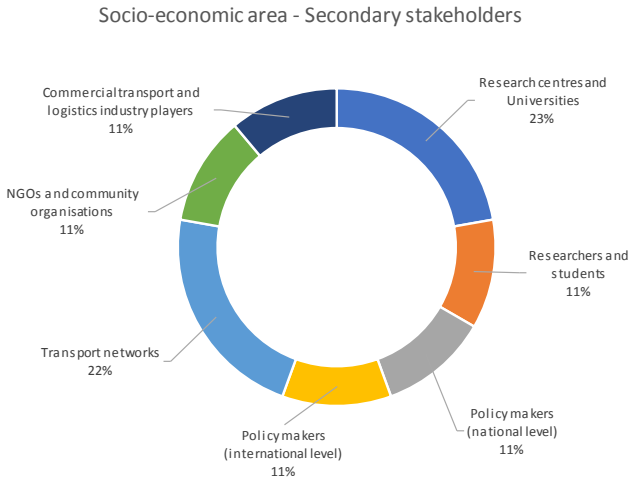

Figure 22: Secondary stakeholders within socio-economic area for original research data sources investigated

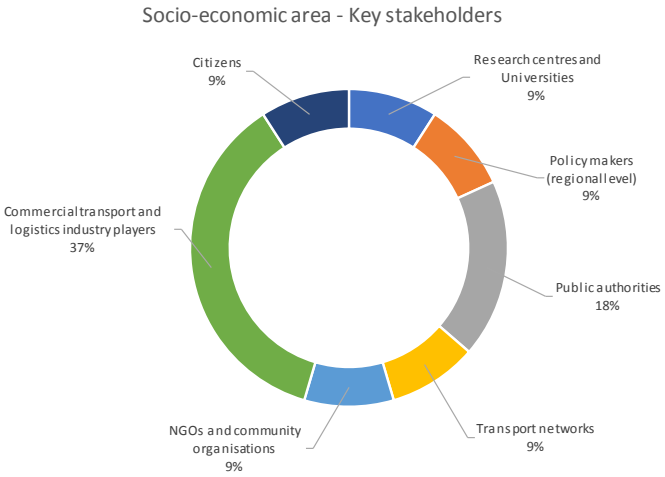

Figure 23: Key stakeholders within socio-economic area for original research data sources investigated

The number of stakeholders in the technological area are significantly lower, with commercial transport and logistics industry players and research centres and universities representing primary stakeholders with an equal share (50%).

Even if the stakeholder categories resulted to be the same, in the case of key stakeholders, different percentages resulted to be assigned to commercial transport and logistics industry players and research centres and universities with 9% and 91% respectively.

Commercial transport and logistics industry players represent also the 83% of secondary stakeholders, followed by research centres and universities (9%) and public authorities (8%).

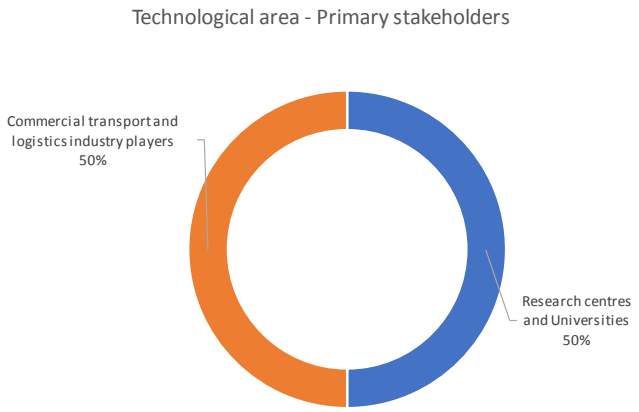

Figure 24: Primary stakeholders within technological area for original research data sources investigated

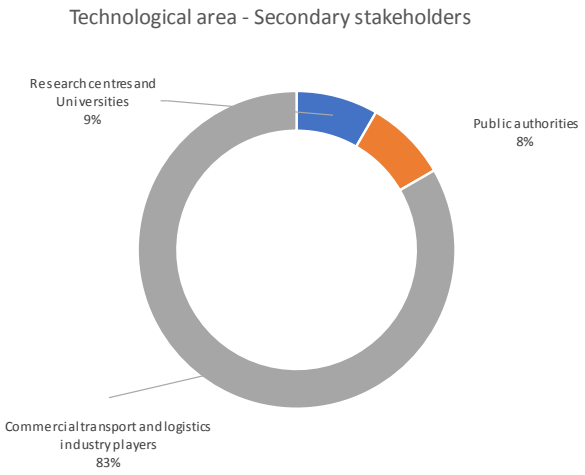

Figure 25: Secondary stakeholders within technological area for original research data sources investigated

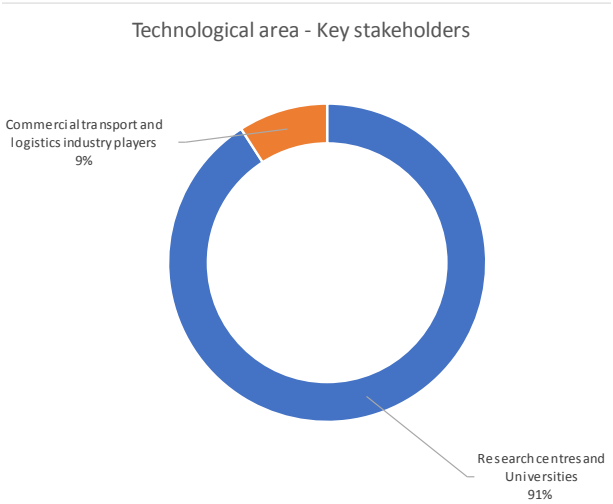

Figure 26: Key stakeholders within technological area for original research data sources investigated

The transport planning area is characterised by a quite numerous type of stakeholders with percentage going from 17% (transport networks, public authorities and research centres and universities) to 8%.

A very different situation is represented by key stakeholders, as only public authorities have been indicated.

An equal percentage (50%) between public authorities and research centres and universities represents the secondary stakeholders.

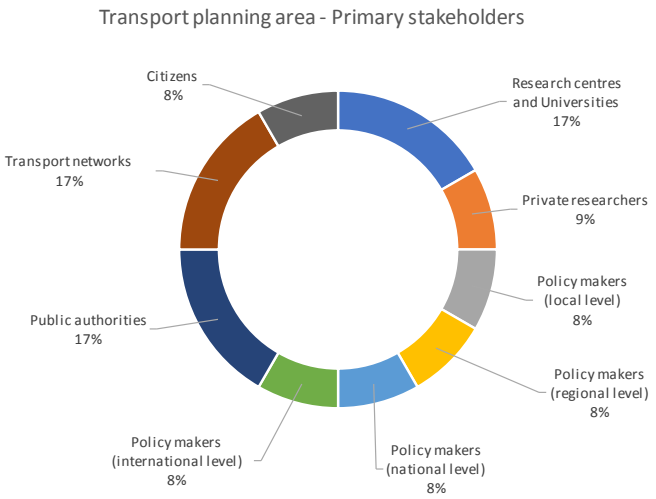

Figure 27: Primary stakeholders within transport planning area for original research data sources investigated

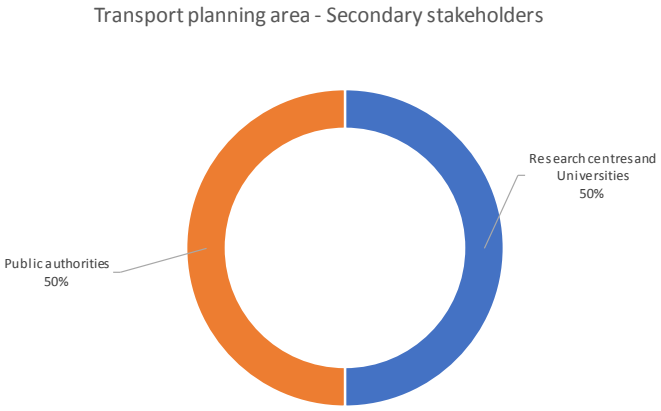

Figure 28: Secondary stakeholders within transport planning area for original research data sources investigated

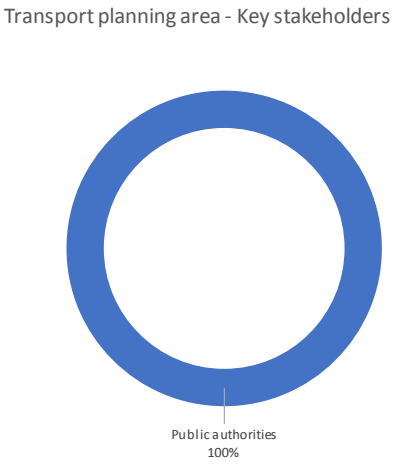

Figure 29: Key stakeholders within transport planning area for original research data sources investigated

3.3.2 Operational data directly related to research

Going through the sources deriving from operational data directly related to research, for both business modelling area and environmental area 100% of primary stakeholders are represented by public authorities. For the business model area the same situation has been reflected also when considering key stakeholders, whereas for environmental area no significant key stakeholders have been recognized.

Also because of the relative small sample used for these two areas, no relevant secondary stakeholders have been identified.

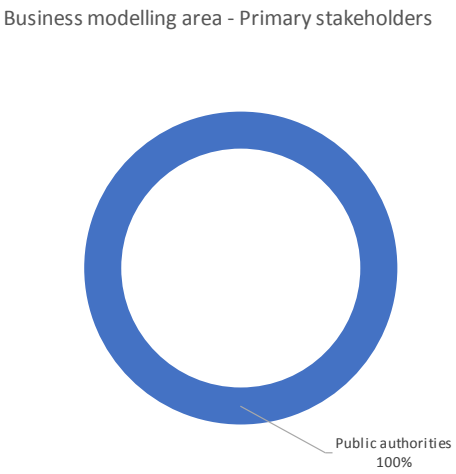

Figure 30: Primary stakeholders within business modelling area for operational data directly related to research sources investigated

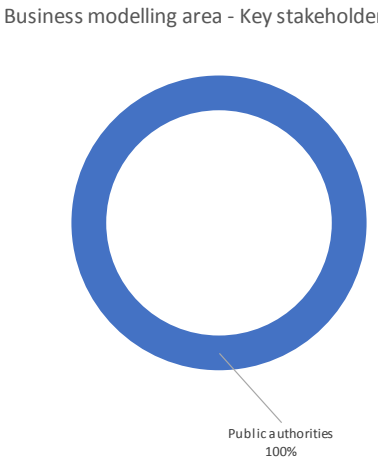

Figure 31: Key stakeholders within business modelling area for operational data directly related to research sources investigated

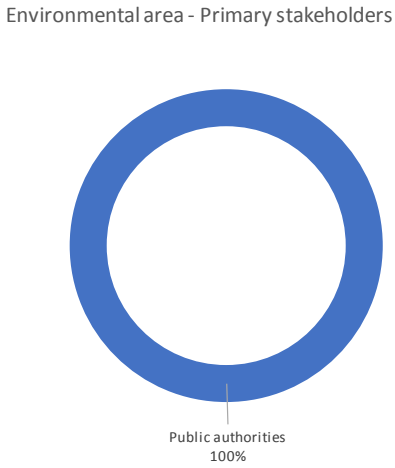

Figure 32: Primary stakeholders within environmental area for operational data directly related to research sources investigated

Two main categories form the primary stakeholders for the legal/regulatory area, namely public authorities with the majority of share (89%) and policy makers at international level (11%).

Also, in this area no significant secondary stakeholders have been detected while the share for key stakeholders resulted to be exactly the same of the primary ones.

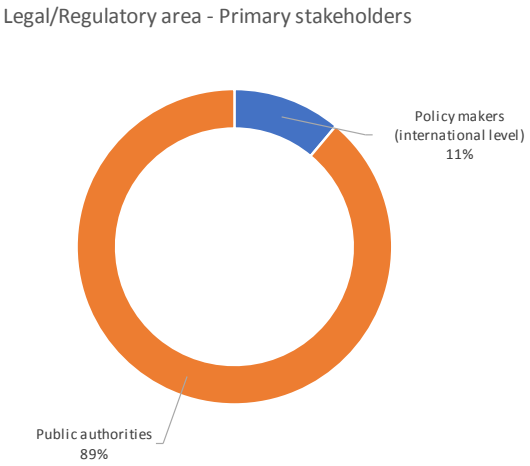

Figure 33: Primary stakeholders within legal/regulatory area for operational data directly related to research sources investigated

Figure 34: Key stakeholders within legal/regulatory area for operational data directly related to research sources investigated

The socio-economic area is characterised by four categories as primary stakeholders. In particular, commercial transport and logistics industry players have a share of 43%, followed by transport networks with 19% and both citizens and public authorities with 14% each.

A similar distribution can be seen when considering key stakeholders; the only exception is the absence of citizens in such a case.

Researchers and students resulted to be secondary stakeholders with 40%; the same percentage has been recorded also for citizens, while transport network represents the third category with a share of 20%.

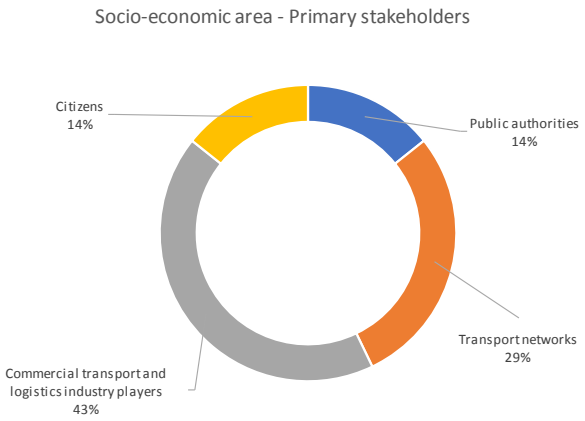

Figure 35: Primary stakeholders within socio-economic area for operational data directly related to research sources investigated

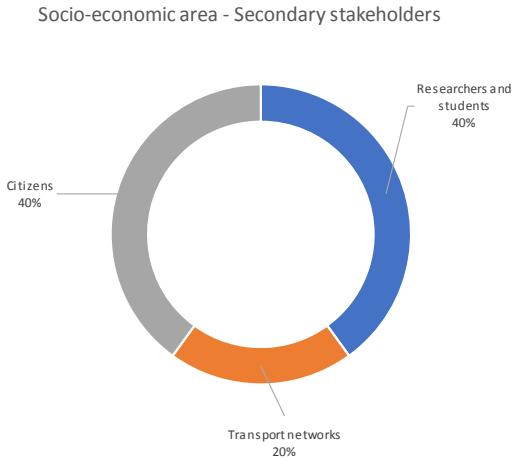

Figure 36: Secondary stakeholders within socio-economic area for operational data directly related to research sources investigated

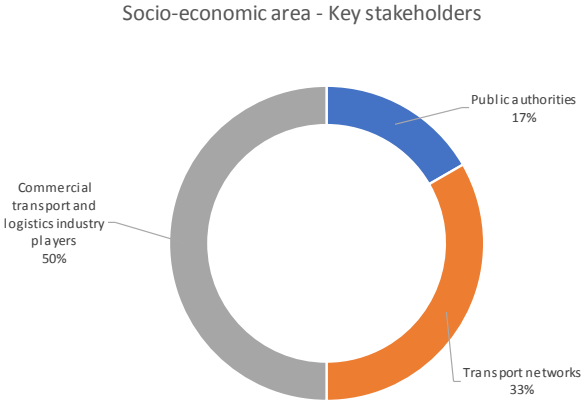

Figure 37: Key stakeholders within socio-economic area for operational data directly related to research sources investigated

Public authorities are the only group being indicated as primary stakeholder for the technological area.

The same situation is reflected if considering key stakeholders. This is mainly due to the fact that publicly available datasets concerning technological transport data are usually owned by public authorities.

Also in this case no secondary stakeholders have been identified.

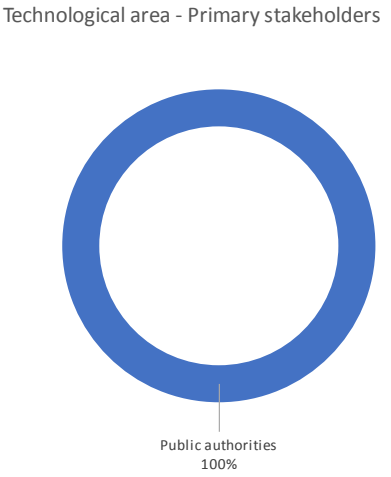

Figure 38: Primary stakeholders within technological area for operational data directly related to research sources investigated

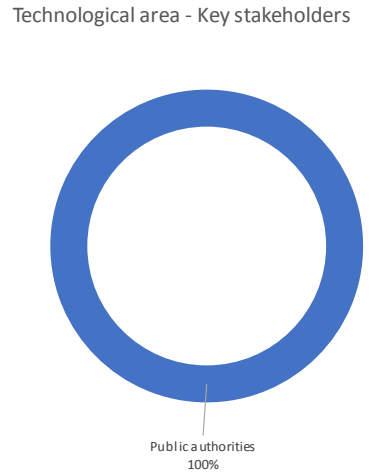

Figure 39: Key stakeholders within technological area for operational data directly related to research sources investigated

Transport planning is the most populated area with six stakeholder groups being primary stakeholders. The highest share is held by public authorities (39%) followed by commercial transport and logistics industry players and transport networks with a percentage of 17% each, while policy makers at international level and researchers and students have both a share of 11%; finally, private researchers appear to have a residual share of 5%.

A similar scenario is depicted for key stakeholders; the only relevant difference is given by the absence of the research representatives (i.e. researchers and students and private researchers) that have been replaced by policy makers at national level.

Public authorities resulted to be the main secondary stakeholders with 56% to which citizens (33%) and researchers and students (11%) follow.

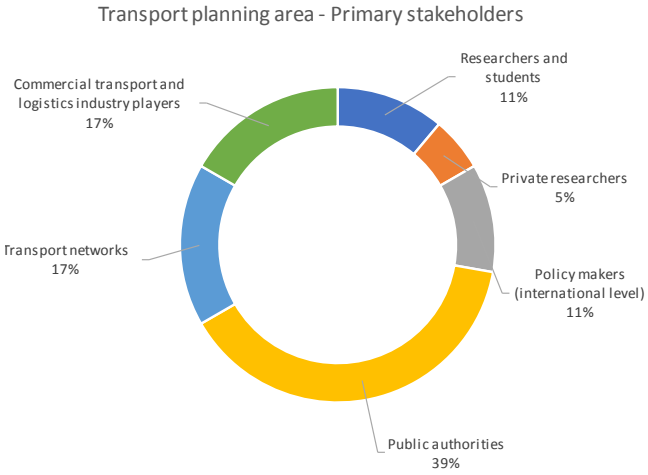

Figure 40: Primary stakeholders within transport planning area for operational data directly related to research sources investigated

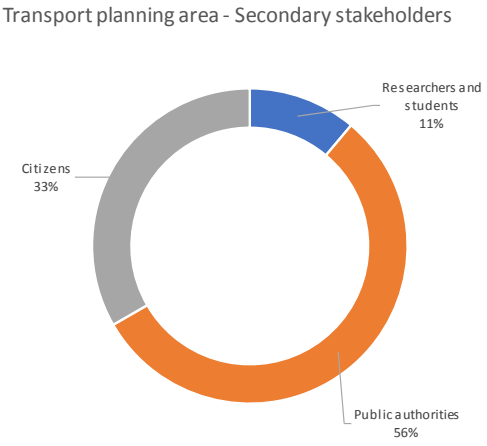

Figure 41: Secondary stakeholders within transport planning area for operational data directly related to research sources investigated

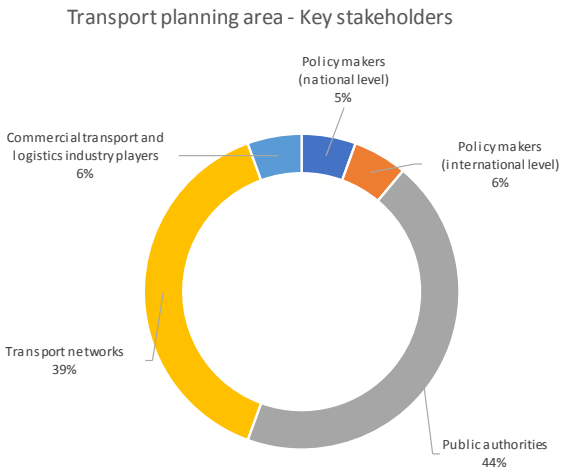

Figure 42: Key stakeholders within transport planning area for operational data directly related to research sources investigated

3.3.3 Data from published transport research

The third main type of source consists of data form published transport research. In this case, given the nature of the scientific sources and also thanks to the appreciable sample collected, numerous stakeholder categories have been identified.

In particular, if considering the business modelling area, eight stakeholder groups are present with commercial transport and logistics industry players holding the highest share (30%) followed by public authorities (25%) and transport networks (16%).

Key stakeholders are a sub-set of primary ones with public authorities, commercial transport and logistics industry players and research centres and universities having a share of 32% each, followed by transport networks with 4%.

Finally, secondary stakeholders are mainly represented by research centres and universities (33%) and NGOs and community organisations (24%).

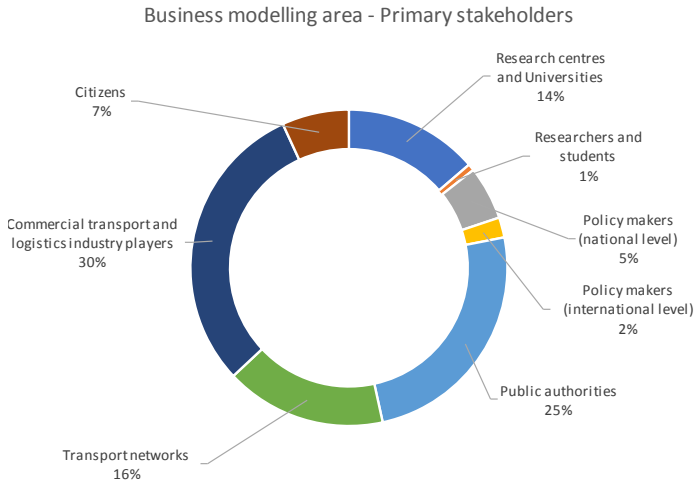

Figure 43: Primary stakeholders within business modelling area for data from published transport research sources investigated

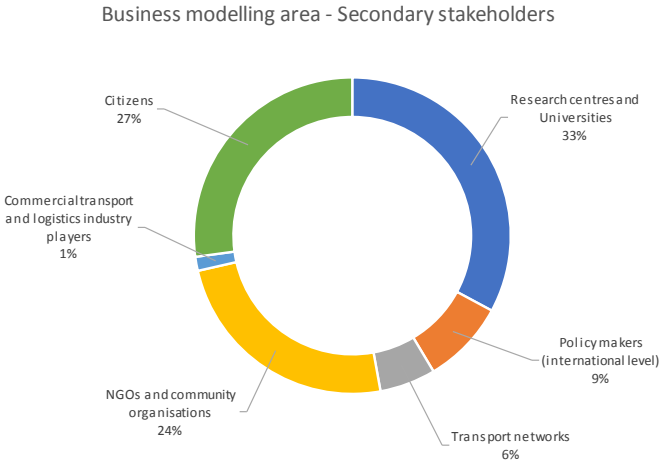

Figure 44: Secondary stakeholders within business modelling area for data from published transport research sources investigated

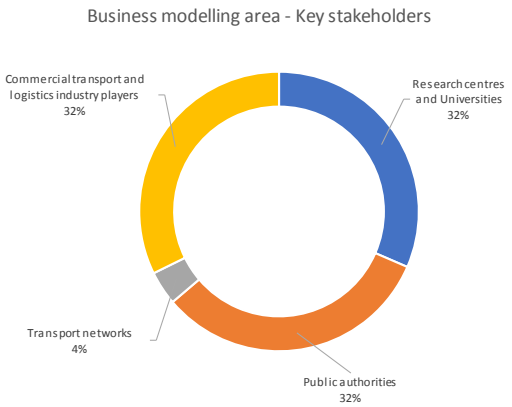

Figure 45: Key stakeholders within business modelling area for data from published transport research sources investigated

Transport networks, public authorities and commercial transport and logistics industry players are the categories with the highest share as primary stakeholders in the environmental area with 25%, 25% and 23% respectively.

A similar situation is depicted for key stakeholders while research centres and universities hold the highest share as secondary stakeholders with a percentage of 44% followed by policy makers at international level with 20%.

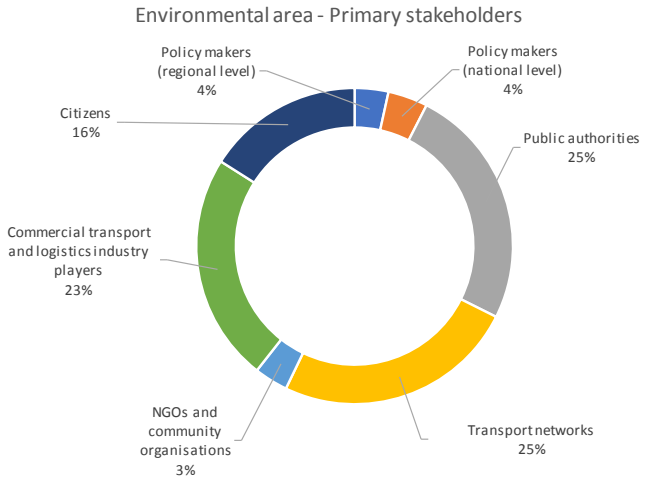

Figure 46: Primary stakeholders within environmental area for data from published transport research sources investigated

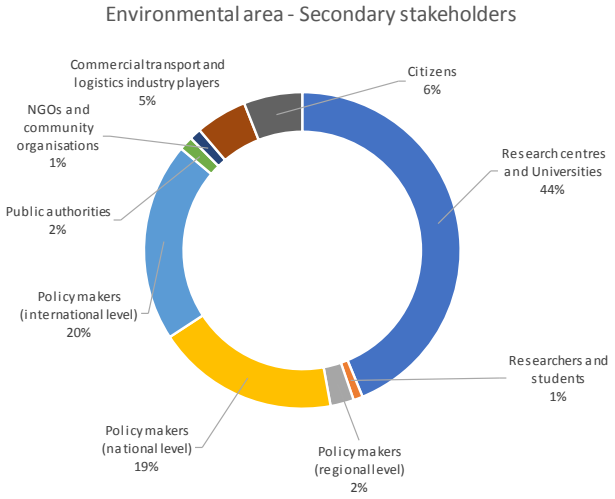

Figure 47: Secondary stakeholders within environmental area for data from published transport research sources investigated

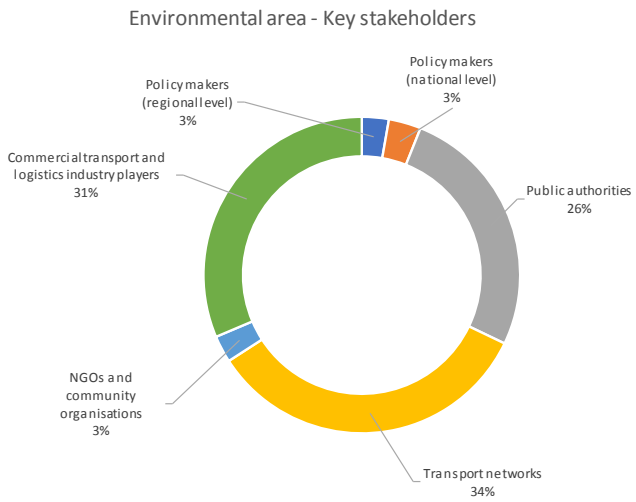

Figure 48: Key stakeholders within environmental area for data from published transport research sources investigated

In the legal/regulatory area policy makers at national level (27%) and public authorities (26%) are the categories mostly represented as primary stakeholders followed by policy makers at regional level (16%) and citizens (11%).

Citizens represent the highest share for secondary stakeholders (45%) followed by commercial transport and logistics industry players (20%).

No relevant groups have been identified as ley stakeholders for what concerns environmental aspects discussed in the scientific sources constituting the sample.

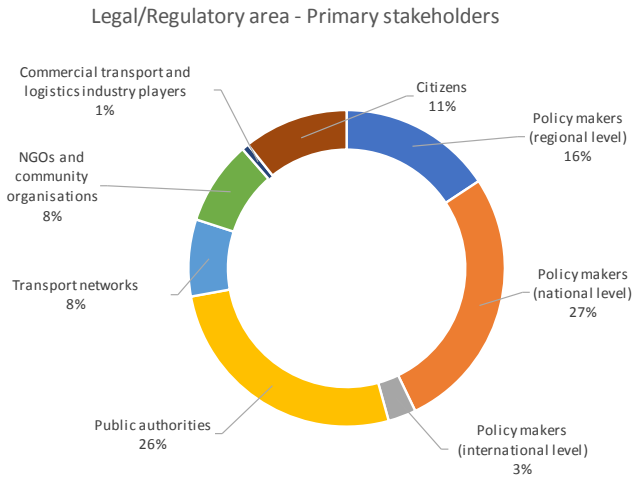

Figure 49: Primary stakeholders within legal/regulatory area for data from published transport research sources investigated

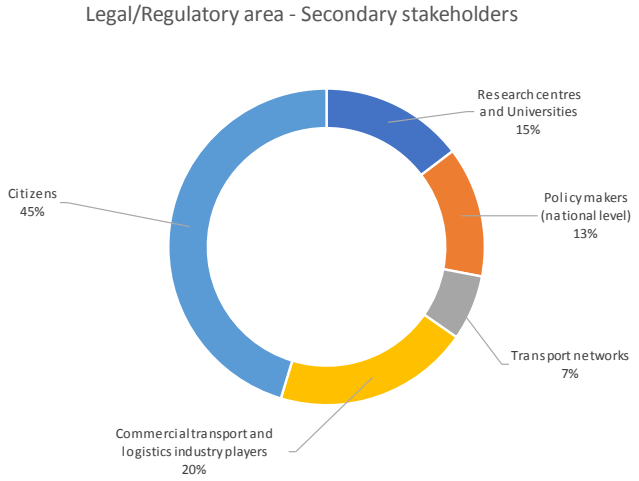

Figure 50: Secondary stakeholders within legal/regulatory area for data from published transport research sources investigated

Transport networks (23%) and public authorities (19%) are the main primary stakeholders within the socio-economic area.

A similar situation is reflected also in the key stakeholders with the only difference that policy makers are present only at regional level while, for primary stakeholders, policy makers at national and international level were also included.

Secondary stakeholders are principally represented by research centres and universities (37%), followed by citizens with a share of 27%.

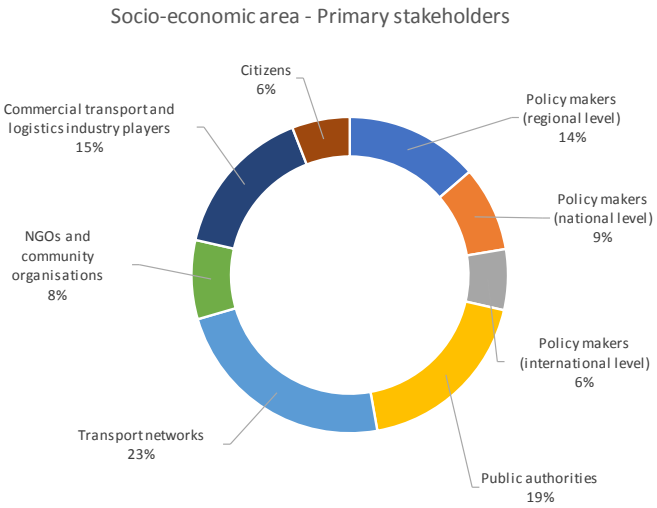

Figure 51: Primary stakeholders within socio-economic area for data from published transport research sources investigated

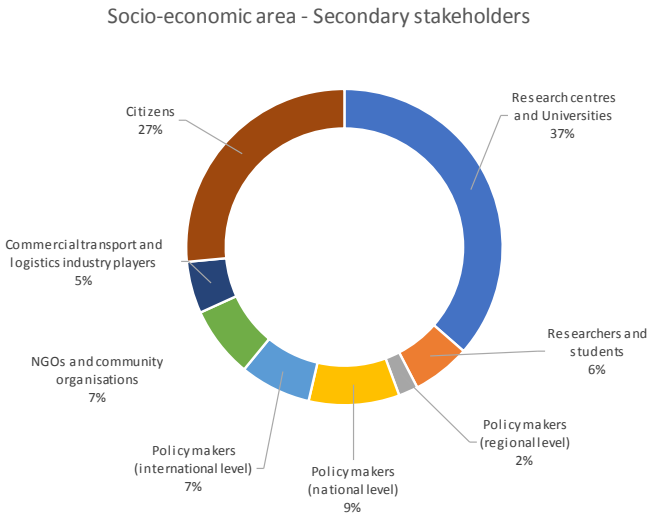

Figure 52: Secondary stakeholders within socio-economic area for data from published transport research sources investigated

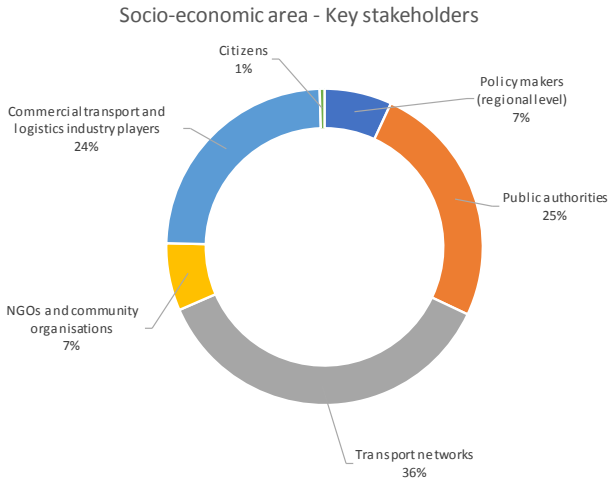

Figure 53: Key stakeholders within socio-economic area for data from published transport research sources investigated

Within the technological area many stakeholder categories are present even if only research centres and universities, commercial transport and logistics industry players and transport networks hold a quite significant share (23%, 25% and 20% respectively).

The same situation can be found when considering key stakeholders.

Research centres and universities are also present with a 35% of share as secondary stakeholders together with private researchers (20%) and policy makers at national level (12%).

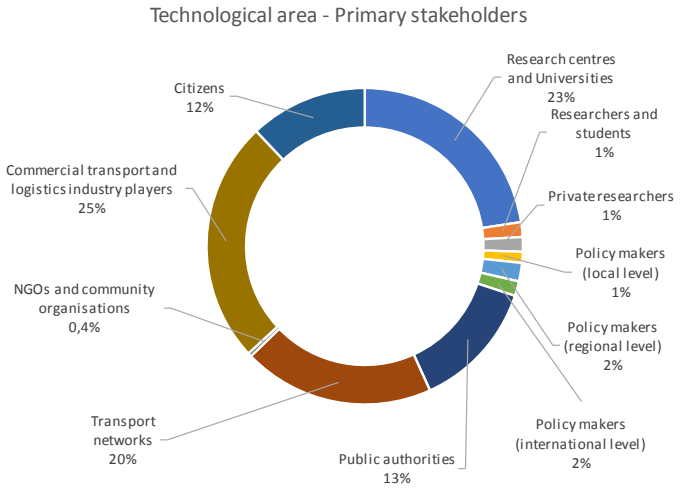

Figure 54: Primary stakeholders within technological area for data from published transport research sources investigated

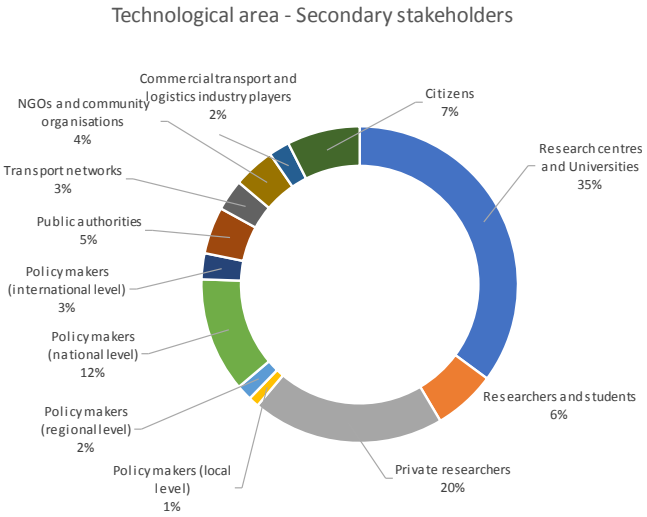

Figure 55: Secondary stakeholders within technological area for data from published transport research sources investigated

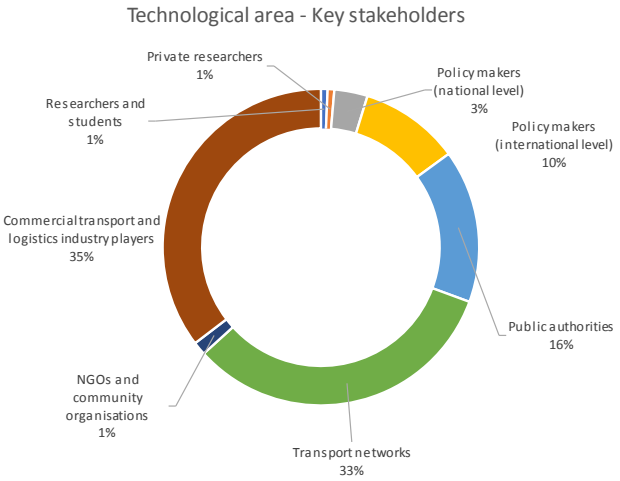

Figure 56: Key stakeholders within technological area for data from published transport research sources investigated

Public authorities, transport networks and also citizens hold the largest share as primary stakeholders within the transport planning area (22%, 21,5% and 21,1% respectively).

A comparable scenario can be found when considering key stakeholders where public authorities and transport networks have the highest share (58,6% and 35,4% respectively).

Secondary stakeholders are in large majority represented by research centres and universities with a percentage of more than 65%.

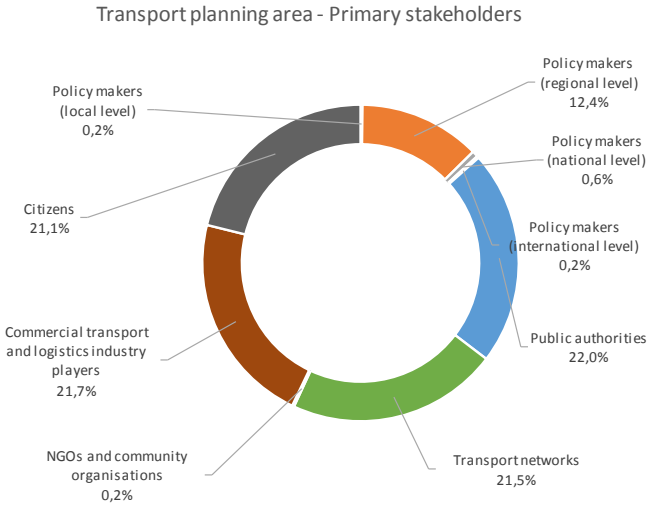

Figure 57: Primary stakeholders within transport planning area for data from published transport research sources investigated

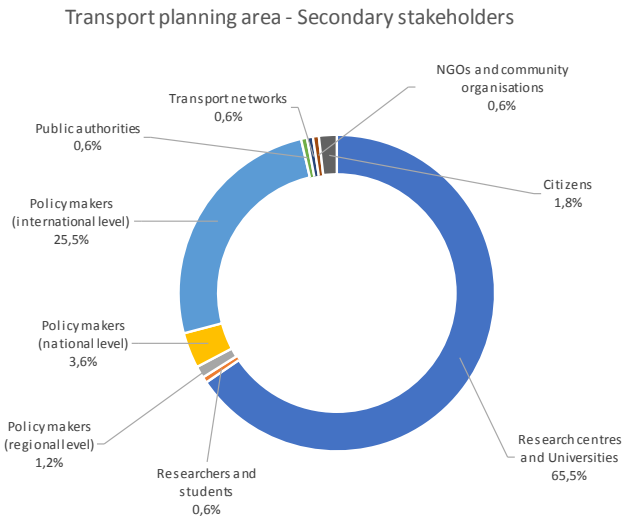

Figure 58: Secondary stakeholders within transport planning area for data from published transport research sources investigated

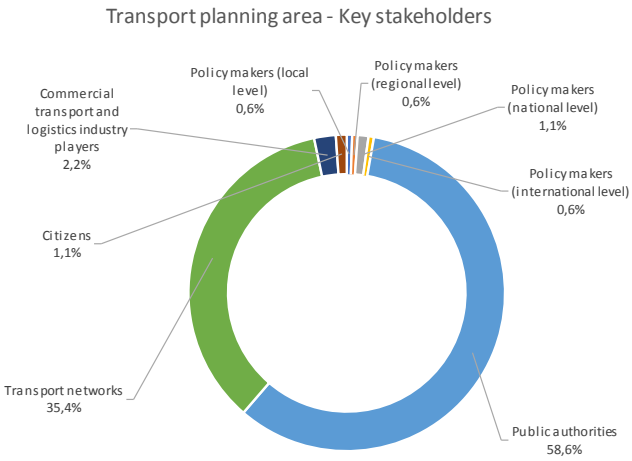

Figure 59: Key stakeholders within transport planning area for data from published transport research sources investigated

4 Main actors' categories

After a first exploration carried out on the basis of scientific sources investigation, to narrow the analysis the focus has been put on three main actors' categories, namely:

- Industry
- Research
- Public Authorities/Ministries

In order to outline the main areas of interest and the most critical issues regarding each of the above-mentioned group, it has been decided to consider:

- For industry, the main technology platforms and their strategies and declarations, namely ERTRAC, ERRAC, WATERBORNE ETP, EIRAC, ACARE, ESTP and ALICE;
- For research, the major influential research organisations, such as ECTRI, EURNEX, EATEO, WEGEMT;
- For public authorities, the ERANET initiative and TRIMIS and CORDIS tools.

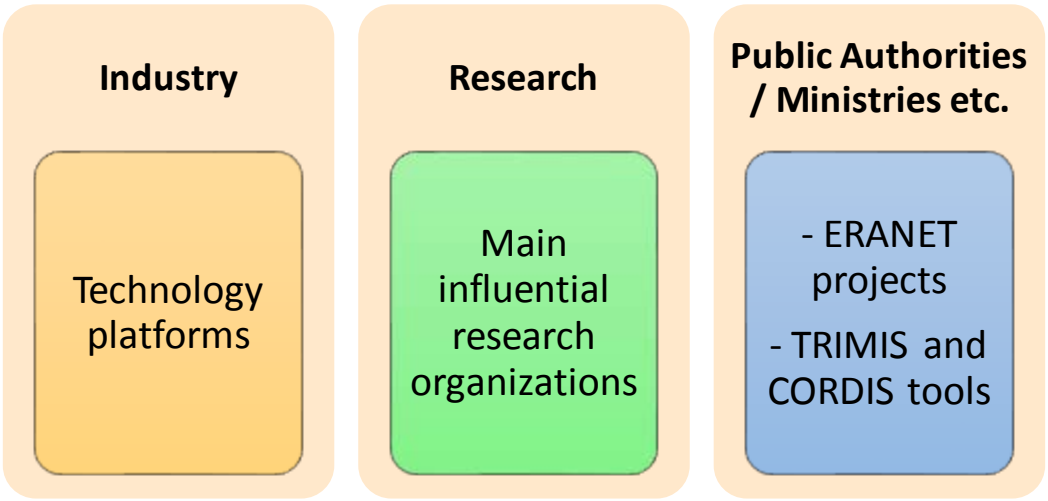

Figure 60: BE OPEN main actors' categories

4.1 Industry

The so-called European Technology Platforms (ETPs) are initiatives having a particular focus on industry and they aim to provide interesting opportunities for international networking. Hence, by taking part in an ETP, stakeholders can collaborate to help shaping the future of European research and deliver on agreed priorities.

In the framework of Horizon 2020 implementation, the EC considers ETPs as having an advisory role. The platforms can be in fact considered as industry-led fora constituted by private and public stakeholders having the main scope of developing research and innovation agendas and roadmaps for activities in their sector of competence.

Among main duties of ETPs there are certainly:

- The development of strategies and the detection of weaknesses in the areas of research and innovation from an industry perspective;
- The mobilisation of stakeholders to foster cooperation;
- The sharing and dissemination of information and knowledge.

ETPs put their attention on strategic issues of main significance in terms of future European growth, sustainability and competitiveness, which rely on major technological progresses. Consequently, they play a key role in determining European research priorities through the development of strategic agendas to appropriately meet industry needs. In order to ensure a long-term collaboration, ETPs team up the most important actors – such as industry, public administrations, scientists, SMEs and end users – in a certain research field. By doing that a wide collaboration could be established in order to cover the entire range of the value chain and so promote a joint vision for future technological development.

The main topics covered by ETPs include:

- Energy
- Environment
- Production and process
- Transport
- Information and Communication Technologies
- Bio-Based Economy

In particular, within the transport cluster the following platforms are included:

- European Road Transport Research Advisory Council (ERTRAC)
- European Rail Transport Research Advisory Council (ERRAC)
- WATERBORNE ETP
- European Intermodal Research Advisory Council (EIRAC)
- Advisory Council for Aeronautics Research in Europe (ACARE)
- European Space Technology Platform (ESTP)
- Alliance for Logistics Innovation through Collaboration in Europe (ALICE)

ERTRAC

The European Road Transport Research Advisory Council (ERTRAC) is the European Technology Platform (ETP) for Road Transport. ERTRAC is recognized and supported by the European Commission.

The tasks of ERTRAC are to:

- Provide a strategic vision for road transport research and innovation in Europe.
- Define strategies and roadmaps to achieve this vision through the definition and update of a Strategic Research Agenda (SRA) and implementation research

roadmaps.

- Stimulate effective public and private investment in road transport research and innovation.
- Contribute to improving coordination between the European, national, regional public and private R&D activities on road transport.
- Enhance the networking and clustering of Europe's research and innovation capacities.
- Promote European commitment to Research and technological development, ensuring that Europe remains an attractive region for researchers, and enhancing the global competitiveness of the transport industries.
- Support the implementation of Horizon 20250, the European Framework Programme for Research and Innovation.

[Source: ERTRAC website]

The main strategy pursued by ERTRAC consist of the following main streams of actions:

- Ensuring mobility in urban areas;
- Enhancing environmental sustainability in terms of energy and resource efficiency, decarbonisation and air quality;
- Guaranteeing an efficient and resilient road transport system;
- Improving connectivity and automation as enablers for improved mobility;
- Increase safety and security towards a “perfect protection”;
- Making Europe a world leader in innovation, production and services;
- Fostering decarbonisation.

In view of the 9th EU Framework Programme ERTRAC published the Strategic Research Agenda[4] with the aim to provide long-term objectives for the improvement of road transport by 2050. By looking into the benefits of innovation for the end users, the document attempts to tie down the research work into societal needs. Hence, the emphasis is put on the importance of mobility and especially road transport for the society and the economy in terms of major transformations brought by alternative energies, electrification, automation, digitalisation and the sharing economy.

In this framework, the support of innovative products and services will be crucial for topics like automation and electrification. Additionally, to carry out all these research efforts in the short and medium-term timeline, a well-balanced funding programme will be fundamental to achieve market introduction of innovations from 2030 onwards. This will allow to lay the groundwork for user involvement and testing in real conditions so bringing together private and public stakeholders involved in transport to work jointly, develop partnerships and implement cross-sectoral collaborations.

[4] “Strategic Research Agenda – Input to 9th EU Framework Programme”, Version: 2.8 Date: 23.03.2018.

The ERTRAC vision then include the following key considerations:

- *"People and goods can reach their destinations in cities in a way that is healthy, safe, affordable, reliable and comfortable"*: the backbone of urban mobility will consist of soft modes of transport assisted by collective and shared mobility services and complemented by private vehicles. In parallel, intelligent and dynamic access regulations together with smart, automated and dynamic parking management and allocation also with the integration of smart charging will foster the achievement of emission free urban areas where people and goods will share spaces and services.
- *"CO2-neutral road transport with minimal environmental impact including circular economy for vehicles and infrastructure"*: the energy for transport will be 100% renewable while charging infrastructure will be guaranteed.
- *"Infrastructure and traffic management provide high efficiency road network services at competitive cost with minimized congestion, regardless of actual conditions and disturbances"*: all transport modes will be characterised by adaptive and flexible traffic and transport management systems while infrastructure services will be based on a "pay as you use" principle and equipped for automated vehicles. Moreover, door-to-door mobility for people and goods will be assured.
- *"Digitalisation enables people to get the best service at highest level of comfort and safety"*: mobility as a service approach will be fostered and seamless mobility including trip planning, pricing and payment assured. Highly automated vehicles will allow for vulnerable users and people with reduced mobility inclusion.
- *"Safe and secure at any time"*: automated driving will allow for a nearly to zero fatalities together with optimised and intuitive Human-Machine Interface also securing privacy with a constant software maintenance and systems updates.
- *"Europe as world leader in innovation, production and services*": cross-sectoral collaborations will be stimulated together with an outstanding education, research and training towards Europe as a lighthouse for innovation process and customer-oriented services.

The following tables summarise the main ERTRAC research trends (Table 6) and topics of interest clustered by area of competence (Table 7).

Table 6: ERTRAC main research trends

ERTRAC research trends		
✓ Connected automated driving technology ✓ IT connectivity ✓ Traffic accidents mitigation (human errors) ✓ Transport system efficiency/ Urban mobility solutions ✓ Facilitation to city	✓ Electrical, automated and shared vehicles ✓ Safety measures & requirements for roads ✓ Balanced & fair framework for research data ✓ Socio-economic impacts/ User/public acceptance	✓ Load handling efficiency ✓ Services provision from hub-to-hub ✓ E-commerce ✓ Smart and connected space management ✓ Plug-in hybrids ✓ High voltage architecture

ERTRAC research trends		
centre access ✓ Road safety ✓ Traffic congestion ✓ Decarbonisation ✓ Mixed traffic environments ✓ Vulnerable road users (VRU)	✓ Big data, Artificial Intelligence and their applications ✓ Policy & regulatory needs ✓ User awareness and training delivery ✓ Business plan for shared mobility ✓ Inter-modality infrastructures ✓ Electrified road systems	✓ enhanced supply chain provenance and ethics ✓ V2I and I2V communication for safety, security, access regulation, pricing and payment, optimal routing (including IT-infrastructure) ✓ Circular economy in transport

Table 7: Main ERTRAC topics clustered by competence area

Competence area	Main ERTRAC topics
Business modelling area	✓ Shared mobility in cities
Environmental area	✓ Traffic efficiency
Legal/Regulatory area	✓ Policy and regulatory needs
Socio-economic area	✓ Social impacts ✓ Inclusive mobility ✓ User awareness ✓ Circular economy in transport
Technological area	✓ Automated vehicles ✓ IT connectivity ✓ Safety systems ✓ ITS applications ✓ Infrastructure connectivity & support systems ✓ Electrified road systems ✓ Digital awareness & resilience ✓ Intelligent goods handling ✓ Smart space management ✓ High voltage architecture
Transport planning area	✓ Traffic efficiency ✓ Accessibility

Table 8: ERTRAC primary and secondary stakeholders

ERTRAC Primary stakeholders	ERTRAC Secondary stakeholders

ERTRAC Primary stakeholders	ERTRAC Secondary stakeholders
✓ Automotive industries ✓ Private research industry ✓ National ministries ✓ Public agencies (i.e. National Energy Agency) ✓ Private & public business schools ✓ Port authorities ✓ European associations ✓ Public universities ✓ Transport equipment production industries ✓ Rail transport operators ✓ Waterborne transport operations & maritime equipment suppliers ✓ Airfreight transport	✓ Citizens or urban areas ✓ Telecommunication industries ✓ IT industries ✓ Small-medium enterprise (SMEs) ✓ Energy & fuel suppliers

ERRAC

ERRAC was set up in 2001 with the ambitious goal of creating a single European body with both the competence and capability to help evolve the European rail sector and make it more competitive, by fostering increased innovation and guiding research efforts at European level.

Within ERRAC, all major rail stakeholders are gathered including railway undertakings, infrastructure managers, manufacturers, the European Commission, the European Union Agency for Railways, EU Member States, academics and users' groups. This enables a broad coverage of all forms of rail transport: from conventional, high speed and freight applications to urban and regional services.

ERRAC's primary objective is to deliver the common railway sector vision of R&I to the European Institutions and important stakeholders, in order to contribute shaping a favorable funding landscape for railway research and innovation, developing innovation via calls for projects and joint undertaking like Shift2Rail.

[Source: ERRAC website]

As promoter of the development of sustainable transport solutions where the rail is the main focus, ERRAC primary objective is to reinforce the position of European railway sector by fostering railway research and innovation collaborations among sector stakeholders. With the role of assisting the implementation of strategy by means of communication with relevant political bodies, it promotes joint research initiatives and shared innovation projects

amongst stakeholders. To this end, the platform is also committed to identify both existing and new financial streams of funding that can be utilised for railway research.

The ERRAC vision at 2050[5] shows how European rail sector will act as a principal mediator of the social and economic transformation and as a fundamental element of the new European industrial base. In this framework, the main topics the innovation-driven foreseen transformation will have to consider to be successful are:

- Mobility: access to mobility services should be guaranteed for all the people regardless of aspects such as language, location, culture and demographics and efficient and seamless transport taking advantage also of the rail system needs to be fostered.
- Logistics: customer demand will drive innovative logistics services and rail systems will need to become fully integrated with the automated multimodal logistic chain to act as grounding of the physical internet, comprising new intelligent, automated cross-modal shipment transfer nodes.
- Smart cities: railways will be a part of smart city planning and an essential and easy access for seamless interchange across all transport modes.

The following tables summarise the main ERTRAC research trends (Table 9) and topics of interest clustered by area of competence (Table 10).

Table 9: ERRAC main research trends

ERRAC research trends		
✓ Intelligent mobility & infrastructure ✓ Traffic accidents mitigation (human errors) ✓ Transport system efficiency / Urban mobility solutions ✓ Decarbonization ✓ Mixed traffic environments ✓ Socio-economic impacts/ User/public acceptance ✓ Big data, Artificial Intelligence and their applications ✓ Policy & regulatory needs	✓ Inter-modality infrastructures ✓ Green rail transport ✓ Rail market liberalization ✓ Network efficiency assessment ✓ Compatible ticketing systems across borders and urban transit legs ✓ Cooling vehicles and stations ✓ Recycling & new applied materials for rail construction ✓ Weight reduction methods to reduce deadweight per passenger	✓ Develop new lightweight and low noise freight wagons ✓ Hot versus cold braking benefits ✓ Low frequency sub-station noise based on research in other sectors ✓ Research into the optimization of the GSM-R network to remove capacity constraints ✓ Noise abatement systems such as low level barriers ✓ Land use ✓ use of satellite

[5] "Rail 2050 Vision – Rail the backbone of Europe's mobility", ERRAC 2017.

ERRAC research trends		
✓ User awareness and training delivery ✓ Business plan for shared mobility	✓ Streamlining the infrastructure for more efficient land use such as removing bottlenecks, building high speed flyovers and reducing the number of level crossings ✓ Improve standards for noise, emissions and diesel engines	navigation for safety critical applications ✓ Innovative maintenance ✓ Cost-benefit analysis methodologies & tools for freight transport ✓ Autonomous train operations

Table 10: Main ERRAC topics clustered by competence area

Competence area	Main ERRAC topics
Business modelling area	✓ Intelligent mobility ✓ Commercial models ✓ Capacity building of infrastructure
Environmental area	✓ Environmental protection ✓ GHG emissions mitigation ✓ Traffic efficiency ✓ Green rail transport ✓ Energy utilization
Legal/Regulatory area	✓ Policy & regulatory needs
Socio-economic area	✓ Social impacts ✓ Inclusive mobility ✓ User awareness ✓ Circular economy in transport ✓ Market liberalization
Technological area	✓ Intelligent mobility ✓ Automated vehicles ✓ IT connectivity ✓ Safety systems ✓ ITS applications ✓ Infrastructure connectivity & support systems
Transport planning area	✓ Traffic efficiency ✓ Accessibility ✓ Network efficiency ✓ Smart city planning

Table 11: Main ERRAC topics clustered by competence area

ERRAC Primary stakeholders	ERRAC Secondary stakeholders
✓ Private research industry ✓ National ministries ✓ Public agencies (i.e. National Railway Agency) ✓ Rail transport operators ✓ Academic institutions	✓ Citizens or urban areas ✓ Telecommunication industries ✓ IT industries ✓ Energy & fuel suppliers

WATERBORNE ETP

WATERBORNE has been set up as an industry-oriented Technology Platform to establish a continuous dialogue between all waterborne stakeholders, such as classification societies, shipbuilders, ship-owners, maritime equipment manufacturers, infrastructure and service providers, universities or research institutes, and with the EU Institutions, including Member States.

The strategic objectives of the WATERBORNE TP are:

- Establish a continuous dialogue between all stakeholders in the waterborne transport sector and in other waterborne-related sectors on R&D;
- Contribute to the widest possible consensus regarding R&D and to focusing of efforts and resources;
- Develop a common medium- and long-term R&D Vision and a Strategic Research Agenda (SRA);
- Contribute to the appropriate mobilisation and allocation of the necessary financial resources (private/regional/national/EU sources);
- Contribute to the social expectations regarding clean, competitive and safe waterborne transport as well as regarding other waterborne-related activities, including education and training.

For WATERBORNE to reach its goals, it is necessary to engage all relevant stakeholders of the European maritime industry, such as classification societies, manufacturers, research institutes, shipyards, ship-owners, or universities, as well as the European Institutions and Member States. This approach should ensure that, whilst national policies will vary according to particular challenges, effective mechanisms are developed to enable adequate research coordination and cooperation between the relevant stakeholders at EU/EEA level.

[Source: WATERBORNE ETP website]

The following tables summarise the main WATERBORNE ETP research trends (Table 12) and topics of interest clustered by area of competence (Table 13).

Table 12: WATERBORNE ETP main research trends

WATERBORNE ETP research trends		
✓ Industry 4.0 in ships & ports, ICT and Artificial intelligence ✓ Process automation ✓ Climate change effects in maritime ✓ Sustainable water ecosystem ✓ Human capital education in port operations ✓ Decarbonisation ✓ Port-hinterland connectivity solutions ✓ Circular maritime economy	✓ Waterborne security ✓ Blue growth business models development ✓ Integrating shipping and inland navigation into seamless port and logistics operations ✓ Water & noise pollution elimination ✓ Risk management and mitigation framework for ship & ports ✓ Traffic management strategies ✓ Environmental impact monitoring systems	✓ Maritime spatial planning ✓ Offshore life installations & infrastructures ✓ Cyber-physical systems & blockchain ✓ Container terminals optimization ✓ Regulatory framework ✓ population growth and urbanization ✓ Food and water demand ✓ Tools for life cycle cost (LCC) planning

Table 13: Main WATERBORNE ETP topics clustered by competence area

Competence area	Main WATERBORNE ETP topics
Business modelling area	✓ Risk management
Environmental area	✓ Blue growth development ✓ Water & noise pollution ✓ Environmental monitoring ✓ Climate change
Legal/Regulatory area	✓ Regulatory framework
Socio-economic area	✓ Development of human capital ✓ Circular economy ✓ Offshore infrastructure & living
Technological area	✓ Automated ships ✓ Industry 4.0, big data & blockchain ✓ Offshore infrastructure & living ✓ Security systems
Transport planning area	✓ Maritime spatial planning ✓ traffic management

Table 14: WATERBORNE ETP primary and secondary stakeholders

WATERBORNE ETP Primary stakeholders	WATERBORNE ETP Secondary stakeholders
✓ Public & Private research industry ✓ Port authorities ✓ Public universities ✓ Public agencies (i.e. National Energy Agency) ✓ Shipyards ✓ Shipbuilding industries ✓ Transport equipment production industries ✓ Waterborne transport operations & maritime equipment suppliers ✓ Energy & fuel suppliers ✓ European associations	✓ Citizens ✓ Port workforce ✓ National ministries

EIRAC

In the year 2004, several European transport associations presented to the European Commission the proposal to establish an Intermodal Research Advisory Council with the objective to define industry needs, relevant business scenario and identify mainstreams for innovations. The existing unimodal Research Advisory Councils for Air, Rail, Road and Waterborne cannot ensure the specific interdisciplinary aspects essential for the necessary progress in this field. EIRAC will be complementary and will cooperate with the other Research Councils.

EIRAC's primary mission is to establish and carry forward a Strategic Research Agenda that will influence all European stakeholders in the planning of research programmes, particularly national and EU programmes. The Strategic Research Agenda is addressed to the Member States, European institutions and stakeholders in the intermodal transport sector.

[Source: EIRAC Terms of Reference]

EIRAC strategy is mainly focused on intermodal transport as the most appropriate choice for the movement of goods in Europe. Intermodal transport will then be an industry that will facilitate Europe to:

- Deal with the growth of demand for transport and associated services
- Reduce the environmental pressure
- Increase competitiveness

To this end, the intermodal transport should achieve a higher quality to change into:

- Seamless: to reduce modal exchange barriers at nodes.
- Reliable: to guarantee timely deliveries and undamaged commodities.
- Available: to offer door to door services at European level.
- Accessible: to provide customers with one stop shops/single entry points.
- Secure: to avoid any infringement.
- Sustainable: to assure the right balance between customer costs and society overall goals.
- Accountable: to allow customers having a single contact point responsible for performance during transport.
- Affordable: to be able to offer competitive prices to customers and enough profits to operators and investors.
- Transparent: to allow all stakeholders understanding the connection between public costs and market prices.

The following tables summarise the main EIRAC research trends (Table 15) and topics of interest clustered by area of competence (Table 16).

Table 15: EIRAC main research trends

EIRAC research trends
✓ Interoperability between modes ✓ Logistics ✓ Security ✓ Socio-economic aspects ✓ Education and training

Table 16: Main EIRAC topics clustered by competence area

Competence area	Main EIRAC topics
Business modelling area	✓ Education & training: o Attract People to Work in the Intermodal Sector. o Harmonise the European Intermodal Education & Training Curriculum (What Should be Taught?). o Develop New Methods of Intermodal Learning and Training.
Environmental area	✓ Intermodality and the environment: o Intermodality needs further research and increase of awareness in the following areas: local and global air emissions, fleet and engine techniques, noise pollution, congestion and accidents.
Legal/Regulatory area	✓ Technical interoperability beyond the generally targeted intramodal interoperability; the seamless logistic chain requires the intermodal technical interoperability. ✓ The information technology has to build a system

Competence area	Main EIRAC topics
	allowing the transport of all necessary accompanying data as loading bill, operational data and the use of relating equipment like tags and electronic seals, compatible with the international satellite positioning systems. ✓ A coherent infrastructure policy has to be defined and executed by the EU and the Member States, so that priorities for investment along the axes appropriate for the growing continental and intercontinental transport flows, are accompanied with suitable financial instruments for their implementation. ✓ Worldwide compatible security and safety standards and rules have to be established.
Socio-economic area	✓ Intermodal transport innovation scenarios: o Identifying the opportunities that changes in world trade and transport have on intermodal transport and in particular the European business community. o Having a permanent structure to identify and prepare strategic scenarios on investments in EU innovations and EU transport capacity.
Technological area	✓ Security: o Harmonisation of the Security Policy Framework. o Security IT Infrastructure. o Physical Security. o Model for the Assessment of Mitigation Measures. ✓ The intermodal train of the future: o trains connecting major network hubs would be pulled by teams of locomotives, driven through lines connecting the sea-hubs with land-hubs, and land-hubs among themselves, mainly dedicated to freight traffic. o Horizontal transhipment will be eased by automatic locking on container castings or on tray castings, in combination with the automatic positioning of the train at the loading floor. ✓ The inland barge of the future: o New markets will be opened for inland navigation by providing innovative vessels for general cargo: they will be used as floating stock, the entire loading and unloading process is automated and it is possible to get the orders for the following port ready en route. o ICT and River Information Services (RIS) will be deployed on a large scale, making use of

Competence area	Main EIRAC topics
	harmonised systems and supporting traffic and transport management along the entire door-to-door logistics chain. ✓ The container vessel of the future: o Container Carriers will be faster, powered by new and greener propulsion systems, using less pollutant fuels, respective to more restrictive regulation on air emissions, and more "silent" to safeguard wildlife at sea. o Very Large Container Carriers will be backed, for regional, Short Sea Shipping and Motorway of the Sea services, by the new generation of feeders which will be featuring higher cruise speed provided by greener engines.
Transport planning area	✓ The network: o The selection of well-defined sea main routes and the efficient integration of ports with the landside and the Trans-European. o Transport Network will be a challenging issue for the future of the overall transport system in Europe, and the market will lead the process to identify the hub-locations. ✓ Sea hubs and the motorways of the sea: o The majority of overseas traffic flows will be served through a limited number of European sea-hubs, i.e., big deep-sea terminals. o The Motorways of the Sea will be the main arterial sea routes to connect the Sea-Hubs to the regional land networks. ✓ Land services, land-hubs and inland terminals: o New and efficient inland waterway services will cooperate with road and rail will be used to cover shorter distances and deliver pallets to retail distribution centres. Conventional inland terminals, as today's ones, will still be operating, serving regional traffic and local distribution. o Vessel emission levels will be drastically reduced and inland navigation will have retained its leading safety and environmental record. o Tri-modal land-hubs will provide fast transhipment between rail, inland waterways and road services. ✓ Interoperability between modes: o Standardized Intermodal Equipment: ▪ How to quickly agree on the design features

Competence area	Main EIRAC topics
	(carrying ability, stackability, handling ease and flexibility) of a standard loading unit for Europe. ▪ The design and implementation of a worldwide compatible loading unit). o Transfer Nodes: ▪ Setting up of a network of transfer nodes around Europe and should encompass the merits of using both public and private sector investment. o Consistent Regulations: ▪ Synchronizing of national regulations applied across many areas of transport across Europe. o IT Systems: ▪ Define the most suitable IT system, which can serve the needs of all the participants. o Transport Documentation: ▪ Harmonizing paperwork/e-paperwork and reducing the number of transport documents. o Systems of Transfer: ▪ Searching the most efficient transfer methods available and into when and where they should be applied. o Awareness of Intermodal Transport: ▪ Searching the best way to promote intermodal transport in all its aspects. ✓ Logistics: o Harmonized Framework Conditions for all Modes. o High Quality and Efficient Intermodal Services. o European Intermodal Network. ▪ The requirements of agile European Transport networks, where many shippers and service providers (and modes) work together.

Table 17: EIRAC primary and secondary stakeholders

EIRAC Primary stakeholders	EIRAC Secondary stakeholders
✓ Industry ✓ Service providers ✓ Universities ✓ Public authorities ✓ The European Commission	✓ Citizens ✓ Transport networks

ACARE

ACARE is the Advisory Council for Aviation Research and innovation in Europe and provides a network for strategic research in aeronautics and air transport so that aviation satisfies the needs of society and secures global leadership for Europe in this important sector.

ACARE is essential in bringing together the right stakeholders to turn the air transport vision in Europe into reality.

ACARE has been in existence since 2001 and comprises European public and private stakeholders who collaborate on a common purpose to develop challenging improvements for aeronautics and air transport in Europe.

[Source: ACARE website]

In line with the challenging objectives of Flightpath 2050[6], ACARE aims at achieving a safer, more efficient and environmental-friendly air transport. At the same time, there is the need to support the global leadership of Europe in this sector by fostering an ambitious supply chain and competitive operators.

The agenda to reach these goals should then include the following key points:

- Meeting societal and market needs.
- Maintaining and extending industrial leadership.
- Protecting environment and energy supply.
- Ensuring safety and security.
- Prioritising research, testing capability and education.

The following tables summarise the main ACARE research trends (Table 18) and topics of interest clustered by area of competence (Table 19).

Table 18: ACARE main research trends

ACARE research trends	
✓ Transportation by a vacuum transit system. ✓ Virtual transport. ✓ Passengers would take their own luggage on-board that could be stored in separate racks in the cabin or stored in the passenger seat. ✓ Separate the passenger from his or her	✓ "Symbiotic Flying"- a concept whereby aircraft could be configured and flown. ✓ High speed personal aircraft using a propeller system for slow and silent take off and a small jet or turbofan engine for cruise flight. ✓ Shortening the turn-around time of aircraft, creation of artificial islands to

[6] "Flightpath 2050 – Europe's Vision for Aviation Report of the High Level Group on Aviation Research", European Commission – Directorate-General for Research and Innovation and Directorate General for Mobility and Transport, 2011.

ACARE research trends	
luggage completely- passenger will only receive the luggage at the destination airport). ✓ Replace hard copy brochures found in the airline pocket seats by electronic brochures that would be displayed on a small screen in front of each seat. ✓ Passenger wellbeing (from on-board massage, an on-board sauna, pool etc. to picnic buffet food). ✓ Reduce the noise in the cabin with anti-noise devices. ✓ Create opposite seating arrangements in the cabin to increase comfort and speed up the boarding process or install side facing seats. ✓ Separate the aircraft outer skin from the pressure hull. ✓ New aircraft concepts put forward included a plasma aircraft, a sub-orbital transport, a Ground Effect Vehicle with sea dipping propulsion pod, a scramjet aircraft, a coanda effect personal transport vehicle and a large commercial autogyro. ✓ Recovering energy expended in braking or in creating vortices or in the water, heat or CO2 and making use of this for propulsion. ✓ "No landing gear system" with the aircraft taking off with some kind of ground power assistance (e.g. a catapult, or rail system) and approaching to land on fixed or variable skids or runners. ✓ Monitor the health of the pilot continuously installing airbags in seats ✓ Bird strike prevention through avoiding costly ground infrastructure and to emit sound from the approaching airplanes.	locate HUB airports. ✓ Circular airport. ✓ Reducing the amount of taxiing. ✓ noise abatement. ✓ Avoiding HUB airports and rely on integrated regional airports. ✓ Hub airport designed around the inter-modal transfer needs of passengers. ✓ Saving of aircraft weight by assisting power for take-off from ground sources, the mechanically hoisted aircraft to achieve potential energy by a lifting apparatus. ✓ "End Plate" launcher. ✓ Whirling take-off ✓ The spiralling rail take-off. ✓ Spiral launched drones for freight. ✓ Banked runways. ✓ Integrated drainage channels leading to drainage conduits to pipe the water away). ✓ Controllers would be provided with a 3D holographic display of the airspace they control. ✓ Design for maintainability, open software architectures, maintenance fees per mile and retrofits. ✓ Towing light aircraft during the take-off phase and climb to altitude. ✓ Save overall expenditure of fuel by allowing airliners to take-off with light fuel loads and then to have their tanks topped up. ✓ A Lighter than Air (LtA) vehicle carrying a large fuel reserve and able to re-fuel airliners in mid-air. ✓ A fleet of UAV tanker aircraft based around a large airship fuel base.

Table 19: Main ACARE topics clustered by competence area

Competence area	Main ACARE topics
Business modelling area	✓ Future Airport Layout ✓ Understand customer, market and societal expectations and opportunities ✓ Design and implement an integrated, intermodal transport system ✓ Develop capabilities to evaluate mobility concepts, infrastructure and performance ✓ Provide travel management tools for informed mobility choices ✓ Deliver mobility intelligence: journey information, data and communication ✓ Provide tools for system and journey resilience, for disruption avoidance and management ✓ Evolve airports into integrated, efficient and sustainable air transport interface nodes ✓ Design and implement an integrated information, communication, navigation and surveillance platform ✓ Develop future air traffic management concepts and services for airspace users ✓ Address cross-cutting issues: system intelligence, human factors and automation support, autonomy and resilience
Environmental area	✓ Optimising fuel burn ✓ Inflight refueling allowing the use of smaller intercontinental aircraft ✓ Develop air vehicles of the future ✓ Increase resource use efficiency and recycling ✓ Improve the environmental performance of air operations and traffic management ✓ Improve the airport environment ✓ Provide the necessary quantity of affordable alternative energy ✓ Understand aviation's climate impact ✓ Adapt to climate change ✓ Develop incentives and regulations
Legal/Regulatory area	✓ Establish efficient and effective policy and regulatory frameworks which ensure a global level playing field and allow European industry to prosper and compete fairly under market conditions in order to stimulate research, technology and innovation
Socio-economic area	✓ Increasing safety
Technological area	✓ Alternative Travelling

Competence area	Main ACARE topics
	✓ The advanced Cabin ✓ Alternative aircraft configurations ✓ Alternative Propulsion ✓ Alternative Aircraft Systems ✓ Advanced Take Off and Landing Ideas ✓ Air Traffic Control (ATC) ✓ Maintenance ✓ Build and exploit safety intelligence ✓ Ensure operational safety ✓ Design, manufacture and certify for safety ✓ Collaborate for security ✓ Engage aviation personnel and society for security ✓ Build and exploit security intelligence ✓ Ensure operational security ✓ Design, manufacture and certify for security
Transport planning area	✓ Linking Passengers to Aircraft ✓ Small Aircraft and Personal Air Transport ✓ Lead the development of an integrated resilient European air transport system that will meet the mobility needs of European citizens as well as the market needs

Table 20: ACARE primary and secondary stakeholders

ACARE Primary stakeholders	ACARE Secondary stakeholders
✓ Research centres and Universities ✓ Transport networks ✓ Commercial transport and logistics industry players	✓ Citizens ✓ Commercial transport and logistics industry players

ESTP

In November 2004, the 1st Space Council recognised the strategic importance of space as a contributor to the implementation of a wide range of European policies. In that respect, the European Space Technology Platform (ESTP) has been established.

The ESTP is the Technology Platform for European space technology implementing the Vision for the deployment of space technologies in Europe for the next decade. It will reinforce and enlarge the coordination of the European efforts to establish a sound, competitive and nondependent space technology base. The ESTP will facilitate interactions between the space sector and related non-space technology platforms and

initiatives, support EU policies and enable services to European citizens.

It will support the enlargement of the Union by helping the integration of new EU Members States in the space sector along agreed roadmaps. The ESTP builds on the success of the established European Space Technology Harmonisation process. Since its launch in 2000, approximately 40 technologies have been harmonised, with the participation of all ESA Member States, Eurospace, Industry, more than 700 Professionals from more than 170 European space companies and research organisations.

[Source: EUROSFAIRE website]

In the space sector a paradigm shift is taking place. Computer technology improvements and enhanced quality standards both in terrestrial commercial components and production methods are bringing the space sector to a wide-ranging offer towards a "New Space Economy"[7]. There are in fact many possibilities deriving from the spin in of technologies and methods developed in other industrial sectors, while at the same time specific space technologies will remain integrally "space-driven".

In this framework, ESTP aims at supporting an approach foreseeing:

- Support for future science and service driven missions, launchers and infrastructure;
- Assistance and reinforcement of European industry competitiveness;
- Boost to innovation and technical excellence;
- Guarantee of non-dependence on critical space technologies;
- Transfer of technology from space to non-space applications and conveyance of innovations from other sectors to space for taking advantage in the design of new space systems.

The following tables summarise the main ESTP research trends (Table 21) and topics of interest clustered by area of competence (Table 22).

Table 21: ESTP main research trends

ESTP research trends
✓ Future Launching Concepts – Micro and Reusable
✓ Optical Communications
✓ Time and Time Standards in GNSS-Systems
✓ CO2-Monitoring from Space
✓ Monitoring the Environment – Local Scale Matters
✓ Small Satellites – Collaborative Constellations
✓ Satellite Sub-systems – COTS Components
✓ Technologies for Compact Sensors – Smart Sensors for New Space and Planetary Exploration

[7] "Selected Trends and Space Technologies Expected to Shape the Next Decade", ESRE White Paper, November 2017.

ESTP research trends
✓ New Optical technologies – Improving detecting and sensing capabilities ✓ Manufacturing for space applications ✓ On-board Processing for Very High Throughput Satellites ✓ Technologies for Autonomous and Cooperative Swarm Exploration

Table 22: Main ESTP topics clustered by competence area

Competence area	Main ESTP topics
Business modelling area	✓ Reinforce and enable innovation and entrepreneurial activity throughout the space sector. ✓ Small launch vehicles showing a promising commercial potential.
Environmental area	✓ The emergence of the Small Satellite Constellations increasing the need for mitigation and avoidance technologies with regard to "space debris". ✓ Active LIDAR-sensor for GHG-measurements.
Legal/Regulatory area	✓ Adapt ECSS-standards to allow for new approaches.
Socio-economic area	✓ Commercial-off-the-Shelf (COTS) approach, in the context of which space companies procure standard terrestrial commercial hardware in order to fly it directly in space or in order to modify it for spaceflight ✓ A transition from the traditional specialised prototype or low-volume development and production established in the space sector towards the exploitation of the benefits of existing mass production technologies. ✓ Space-based telecommunication represents the largest commercial activity of all space-related markets.
Technological area	✓ Develop space-based solutions and technologies answering to new enlarged EU needs, to prepare and enable future European Space Programs. ✓ Develop the new architecture and technology needed for future systems/spacecraft. ✓ Demonstrate new space-based applications. ✓ Identify and develop disruptive technologies, search systematically for non-space technologies that can be used for space solutions. ✓ Promote breakthrough innovative high-return technologies. ✓ Leverage on non-space automotive technology, enabling the acquisition/master of selected, pre-established technological capabilities (spin-in).

Competence area	Main ESTP topics
	✓ Match available space technologies with the non-space needs and subsequently provide assistance in the transfer process (spin-off). ✓ Galileo will be run as a business partnership between the public and private sectors, and profits would be ploughed back into further development and system replenishment on the below sectors: Air traffic management, Road traffic monitoring and driver assistance, Railways applications.
Transport planning area	✓ Organization and management of mobility and global transport system with GNSS, not only for navigation but also for tracking and tracing of vehicles and cargo. ✓ Collaborative Small Satellite Constellation for smart Green Transport.

Table 23: ESTP primary and secondary stakeholders

ESTP Primary stakeholders	ESTP Secondary stakeholders
✓ Research centres and Universities ✓ European Space Industry ✓ The European Space Agency ✓ National Space Agencies and Organisations ✓ Public authorities	✓ Citizens

ALICE

The European Technology Platform ALICE is set-up to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovation in Europe. The platform will support and assist and advise the European Commission into the implementation of the EU Program for research: Horizon 2020 in the area of Logistics.

ALICE was created in the frame of WINN project having the European Green Cars Initiative (logistics section) and EIRAC, European Intermodal Research Advisory Council, as background and supporting initiatives. ALICE was officially recognized as a European Technology Platform by the European Commission in July 2013.

ALICE is based on the recognition of the need for an overarching view on logistics and supply chain planning and control, in which shippers and logistics service providers closely collaborate to reach efficient logistics and supply chain operations. ALICE engages with all

different kind of stakeholders operating in the Logistics sector.

[Source: ALICE website]

The European Technology Platform on Logistics aims at providing its contribution to the development of new logistics and supply chain concepts and innovation towards a more competitive and sustainable industry.

This translates into the attempt to contribute to a 30% improvement of end to end logistics performance by 2030. To this end, more efficient, competitive and sustainable supply chains need to be deployed. ALICE will bring its assistance by bringing together relevant stakeholders, such as shippers, logistic service providers, transport companies, terminal operators, support industry (Finance, ICT, Equipment/vehicle/vessel manufacturers, infrastructure providers, inspections) and research and education institutions.

The collaboration among the different actors involved in logistics will then allow to:

- identify commonly agreed research and innovation strategies, roadmaps and priorities;
- stimulate and accelerate the taking up of innovation in logistics and supply chains;
- Learn and put into practice new logistic technologies and business processes;
- Provide a contribution towards a stronger coordination of European, national and regional innovation programmes in logistics;
- Offer a network for interdisciplinary collaborative research involving industry, academia and public institutions.

The following tables summarise the main ALICE research trends (Table 24) and topics of interest clustered by area of competence (Table 25).

Table 24: ALICE main research trends

ALICE research trends
✓ Sustainable, Safe and Secure Supply Chain ✓ Corridors, Hubs and Synchromodality ✓ Information Systems for Interconnected Logistics ✓ Global supply network coordination and collaboration ✓ Urban freight

Table 25: Main ALICE topics clustered by competence area

Competence area	Main ALICE topics
Business modelling area	✓ Innovative Supply-Chain Design based on Integrated Synchromodal Services ✓ Hubs and Network Integration for a resilient supply-chain

Competence area	Main ALICE topics
	✓ Increase asset and infrastructure utilization by Sharing ✓ Collaboration Tools ✓ Revenue/Gain sharing ✓ Integration of manufacturing and logistics ✓ Favouring the transition to the new collaborative environment ✓ Understanding the impact of collaborative logistics ✓ Value creation logistics services and more efficient operations ✓ E-commerce implications: Direct to consumer deliveries and functional ✓ Logistics services ✓ Reverse logistics and transport of waste and recycling material ✓ Designing and operating urban freight delivery infrastructures
Environmental area	✓ Emission reduction ✓ Increased re-use ✓ Better understanding of the impact of land use on urban logistics activities ✓ Cleaner and more efficient vehicles
Legal/Regulatory area	✓ Security, privacy and trust ✓ Data ownership ✓ Information & data sharing policies ✓ Supportive legal and regulatory practices
Socio-economic area	✓ Supply chain cost reduction ✓ Safety and security in urban freight
Technological area	✓ Intelligent objects, smart devices, IoT and ITS ✓ Dematerialization ✓ Intelligent information nodes ✓ PI support and planning systems ✓ Logistics Business Process as a Service (BPaaS) facilitates ✓ Autonomous logistics operations
Transport planning area	✓ Transport reduction (percentage of overall value) ✓ Improved carrier/ULD utilization (volume/weight) ✓ Supply chain service improvement (quality and due date reliability) ✓ supply chain security ✓ Strategic collaborative logistic network design ✓ Tactical planning and execution of collaborative networks ✓ Resilience capabilities and risk management of

Competence area	Main ALICE topics
	collaborative networks ✓ Business models and change management for collaborative services ✓ Coordinated planning of supply chain and logistic services ✓ Synchronization and dynamic update of logistics operations in open networks ✓ Overcoming data-sharing barriers in collaborative networks ✓ Identifying and assessing opportunities in urban freight ✓ Towards a more efficient integration and management of urban freight in the transport system of the city ✓ Enabling a more efficient management of goods ✓ Improving the interaction between long distance freight transport and urban freight ✓ Better adapting the vehicles to innovative urban freight delivery systems

Table 26: ALICE primary and secondary stakeholders

ALICE Primary stakeholders	ALICE Secondary stakeholders
✓ Shippers and Logistics Service Providers ✓ Transport companies ✓ Terminals and terminals operators ✓ Industry ✓ Research centres and universities	✓ Citizens ✓ Transport networks

4.2 Research

The second main actors' category analysed has been constituted by the major influential research organisations. After having examined research trends and topics of main interest for the industry sector – represented by the European Technology Platforms – a similar investigation has been carried out for understanding if the interests of research organisations on transport main themes coincide or if the focus is put on different aspects.

ECTRI

The European Conference of Transport Research Institutes (ECTRI) is an international non-profit association that was founded in April 2003 by 15 national transport research institutes and universities of 13 European countries, as a non-profit association registered in France and governed by French law. It is the first attempt to unite the forces of the foremost multimodal transport research centres across Europe and to thereby promote the excellence of European transport research.

Today, it includes 28 major transport research institutes or universities from 21 European countries. Together, they account for more than 4,000 European scientific and research staff in the field of transport.

ECTRI as the leading European research association for sustainable and multimodal mobility is committed to provide the scientifically based competence, knowledge and advice to move towards a green, safe, efficient, and inclusive transport for people and goods.

Linked to its establishment in Brussels, ECTRI is operating since January 2011 as an international non-profit association (AISBL) registered in Belgium and governed by Belgian law. The constitutive and authentic Act was approved by Notary deed on September 6th, 2010 and the legal personality given to the Association by Royal Decree approved on November 2nd, 2010.

[Source: ECTRI website]

ECTRI policy is mainly focused on supporting the development of European transport research. To this end networking, information exchange and cooperation among both Members' institutes and wider stakeholder community will be fostered. Thanks to the multimodal and multidisciplinary approach and expertise of its member institutes new competences could be acquired by the network and strategic partnerships also with other associations created.

ECTRI then acts as a platform for creating new research and business opportunities both at European level and at global research arena dimension. At the same time, the ECTRI participation and input to forums where transport and transport research policies are formulated can ensure visibility for the member institutes.

On the other side, by taking part to R&D projects, ECTRI will enhance the cooperation with the private sector and connections with industry. At the same time, this aims at accelerating the deployment of research results in technological, service, as well as business solutions.

The following tables summarise the main ECTRI research trends (Table 27) and topics of interest clustered by area of competence (Table 28).

Table 27: ECTRI main research trends

ECTRI research trends
✓ The future European Research Area ✓ Exploitation of joint research capabilities and infrastructures ✓ Training and networking for senior scientists

Table 28: Main ECTRI topics clustered by competence area

Competence area	Main ECTRI topics
Business modelling area	✓ E-freight ✓ Door-to-door freight transport and supply chains
Environmental area	✓ Land-use and transport interaction
Legal/Regulatory area	✓ Policy analyses (e.g. scenarios, foresights) ✓ Public Private Partnership ✓ Evaluation of policy initiatives
Socio-economic area	✓ Travel behaviour ✓ Inter-modal aspects of urban mobility ✓ Land-use and transport interaction ✓ Cost benefit analyses ✓ Pricing and externalities ✓ Behavioural adaption and change on safety issues ✓ Fitness to drive ✓ Ageing society ✓ Injury data
Technological area	✓ Communication and positioning technologies ✓ Cooperative systems
Transport planning area	✓ Inter-modal aspects of urban mobility ✓ Urban logistics ✓ Terminals ✓ Risk Analysis and Management ✓ Critical infrastructures ✓ Needs of users/ operators/ owners/ emergency services ✓ Traffic modelling ✓ Traffic control

Table 29: ECTRI primary and secondary stakeholders

ECTRI Primary stakeholders	ECTRI Secondary stakeholders
✓ Research centres and universities ✓ European Technology Platforms (ETP) and forums active in all transport areas ✓ Commercial transport and logistics industry players ✓ Policy makers (international level)	✓ Transport networks ✓ Policy makers (national, regional and local level) ✓ NGOs and community organizations ✓ Citizens

EURNEX

On October 30, 2007 the European rail research was set up on a new quality. EURNEX, the EUropean rail Research Network of Excellence, as an association according to the German law was founded at the TSB-FAV premises in Berlin.

The EURNEX Network of Excellence comprises of 35 scientific institutes in the area of transport with particular expertise in rail research all over Europe and China. As direct docking points to the research customers, the international associations UIC, UNIFE and UITP were also members of the EURNEX EU project and nowadays are integrated in the Advisory Board of the association.

With EURNEX, the integration of the excellent European rail researchers has been achieved and EURNEX becomes more and more visible in the top rail research on international level. This includes the launch as well and the further development of EURNEX Scientific Poles of Excellence.

[Source: EURNEX website]

The main purpose of the EURNEX consists in establishing a European network of rail research institutes acting as world-class player in order to sustain the railway sector and facilitate the enhancement of an interoperable and competitive rail system across Europe. EURNEX therefore aims at:

- Linking up the fragmented European rail research landscape;
- Encouraging railway contribution to European sustainable transport policy;
- Strengthening railway sector competitiveness and economic stability towards the creation of a customer-oriented and durable network;
- Boosting technological innovations and knowledge management;
- Implementing knowledge for different actors of rail sector ranging from scientific institutes to rail operators, infrastructure managers and supply industry;
- Fostering co-operation in research and education as well as knowledge transfer between the Members, European universities and research institutions.

The following tables summarise the main EURNEX research trends (Table 30) and topics of interest clustered by area of competence (Table 31).

Table 30: EURNEX main research trends

EURNEX research trends		
✓ Main drivers of demand and costs in railways ✓ Potentials and limitations of quality of service rendered by railways to the various market segments ✓ Actions from regulators and policy makers that could help to improve railway performance ✓ Intelligent mobility ✓ Stakeholder requirements ✓ Interoperability ✓ Functional analysis and designing of system architecture and components relationships ✓ Modelling and simulation ✓ Technical and operational safety ✓ Occupational health and safety ✓ Safety impact of maintenance ✓ New technology for security ✓ Psychological aspects of security ✓ Prevention of terrorism ✓ Energy consumption and saving in electrified and diesel traction systems ✓ Electromagnetic pollution; noise and	✓ Operation planning and management ✓ Capacity management and optimization ✓ Improving the performance and the attractiveness of passenger and freight vehicles ✓ Maintaining and enhancing safety and reliability ✓ Provide scientific and technical foundation for innovative solutions and supporting the establishment of new standards for rolling stock ✓ Research and development to improve methods of assessment ✓ Knowledge management system on PQM and the application of simulation methods ✓ Information systems (passenger, freight, remote diagnostics, predictive maintenance, traffic management) ✓ Ticketing and payment/refund systems ✓ Security (systems and users)	✓ Water and air pollution ✓ Track including sub-grade and rail ✓ Incident/accident database and learning ✓ Risk analysis and assessment ✓ Switches and crossings; level crossings ✓ Wheel/rail interface ✓ Signalling and control systems ✓ Line-side equipment ✓ Railway structures, cuttings and embankments ✓ Remote condition monitoring ✓ Electrical power distribution ✓ Maintenance procedure ✓ Catenary ✓ Life cycle cost (e.g. in relation to maintenance) ✓ Noise, vibration and corrugation ✓ Signalling compatibility ✓ Interlocking

EURNEX research trends		
vibration not only on board but also on ground ✓ Influence of weather conditions on railway operation	✓ Railway system management ✓ Safety and security management ✓ Active safety and passive safety requirements and assessment	

Table 31: Main EURNEX topics clustered by competence area

Competence area	Main EURNEX topics
Business modelling area	✓ Business cases on common EU strategy in connecting big metropolis by high speed rail ✓ Rail integration in urban freight distribution
Environmental area	✓ Reuse and recycling in the railway and transport sector ✓ Batteries for electric driving, regenerative braking, alternative power sources ✓ Energy harvesting for fixed and moving equipment, electrification of railway wagons
Legal/Regulatory area	✓ Requirements and standards for long distance night passenger services ✓ Development of standards for neighbouring cross-border signal boxes ✓ Investigation regarding a unified language for European railway operations ✓ Research into the organizational and regulatory environment to encourage the adoption of innovations (for instance wagons exceeding dimensions)
Socio-economic area	✓ Service economics incl. knowledge of service requirements of shippers and of passengers and how these are addressed by competing modes ✓ Market requirements for rail services to be able to attract typically non-rail freight users, e.g. high value consumer goods, LDHV (low density) or temperature-controlled goods, high speed freight ✓ Long term trends in society and technology that influence mobility patterns, appraisal of the costs and benefits of alternative innovations ✓ Continued development of pricing for cross-border passenger transport (CIV) ✓ Security and safety for high value freight ✓ Evaluation of increased safety and reliability of railway

Competence area	Main EURNEX topics
	infrastructure after its modernization or reconstruction ✓ Holistic approach embracing cognitive, physical and organisational human factors ✓ Promote systems ergonomics within a systems engineering philosophy
Technological area	✓ New materials for energy absorption, noise and damping ✓ Aerodynamics (incl. freight, container trains) ✓ Smart vehicles incl. wagons ✓ Railway dynamics and damage processes and rolling noise creation mechanisms ✓ Structural new materials and optimized layouts ✓ Fatigue behaviour; impact resistance; durability; inspection and repair; production and joining processes; fire resistance of new materials ✓ Electronic transmission for movement commands in case of failure of control and safety systems ✓ Research on the implementation status of TSIs in the EU, and very importantly, measures for accelerating implementation ✓ Future capabilities such as dynamic spectrum allocation, millimetre-wave based smart railway communications, LTE (Long Term Evolution std.) based broadband communications for high-speed railway ✓ Dependability aspects on wireless communications. This aspect is treated in the case of GNSS but not for T2G, T2T communications ✓ Passenger ticketing improvements with harmonization and exchange of relevant data, unified personal ticket storage ✓ Innovative uses of Automatic Load Checkpoint data: predictive maintenance, authorisation to place in service and more ✓ Low cost failsafe train positioning for port-area railway networks ✓ Cybersecurity, ransomware protection, personal data protection, company data protection ✓ Integration of key locks in ETCS ✓ ETCS Level 3 implementation for end of train devices ✓ Research on methodologies allowing correlation between cost and levels of safety improvement ✓ Satellite positioning systems and own traffic monitoring systems for the detailed real time information for safety and security ensuring services

Competence area	Main EURNEX topics
	✓ Batteries for electric driving, regenerative braking, alternative power sources ✓ Energy harvesting for fixed and moving equipment, electrification of railway wagons ✓ Aerodynamic studies for trains including freight trains (container trains) ✓ Reference values and target values for port-area railway track (including switches and crossings) ✓ New designs of slab track, more resilient against deterioration, easily reparable after terrain movements or torrential down powers, storms and floods ✓ Modern design of railway stations and marshalling yards. ✓ Defrosting of railway infrastructure (esp. contact wire in railway, tram and trolleybus transport) ✓ Modern methods in modelling of noise and vibration originated in railway transport and mitigation measures. ✓ Auto-learning or co-learning capacities and cooperative capacities for technology ✓ Database studies of the negative/positive impacts for a system because of the occurrence of human errors or violations
Transport planning area	✓ Operation on high density mixed traffic networks ✓ Integration of battery powered trains into existing timetables ✓ Cross-border train slot booking (incl. Freight), assignments and synchronization of timetables and train circulations intra EU for longer distances of transport ✓ Enlarged capacity of railway system: faster, heavier, and larger trains; soft infrastructure capacity enlargement

Table 32: EURNEX primary and secondary stakeholders

EURNEX Primary stakeholders	EURNEX Secondary stakeholders
✓ Research centres and universities ✓ Rail operators ✓ Infrastructure managers ✓ Supply industry	✓ Policy makers ✓ Private researchers

EATEO

Given the continuous increase in traffic and the increasing number of regulations by EASA, ICAO and other Organisations, as well as the constant development of aviation technology, it is generally recognized that training in aviation is an important factor for safety and the effective operation of all sectors of the industry.

Yet, in contrast with other parts of aviation, no organization representing collectively the European training providers and the relevant Educational Establishments exists. This constitutes a deficiency, which has been recognized by ICAO, ECAC and other European Institutions, as well as by the training industry itself. Some efforts to create such Organisation in the past have not materialised for different reasons, including the fact that these efforts were made by institutional regulators rather than the industry itself.

On these grounds, the European Association of Aviation Training and Education Organisations (EATEO) has been created as a non-profit organisation, registered by Cyprus law in June 2016. The membership is open to all academies, schools and institutes of the aviation industry.

[Source: EATEO website]

As its main objective EATEO aims at offering a common forum for European aviation training and aviation education providers, to let them contribute to aviation safety and other fields of civil aviation. At the same time, EATEO will sustain the aviation trainers' common interests in European and International environments.

The following tables summarise the main EATEO research trends (Table 33) and topics of interest clustered by area of competence (Table 34).

Table 33: EATEO main research trends

EATEO research trends
✓ Development and enhancement of best aviation training and education practices

Table 34: Main EATEO topics clustered by competence area

Competence area	Main EATEO topics
Business modelling area	*Since EATEO main purpose is aviation training and education the business modelling area is not part of main topics of interest.*
Environmental area	*Since EATEO main purpose is aviation training and education the environmental area is not part of main topics of interest.*
Legal/Regulatory area	*Since EATEO main purpose is aviation training and education the legal/regulatory area is not part of main*

Competence area	Main EATEO topics
	topics of interest.
Socio-economic area	*Since EATEO main purpose is aviation training and education the socio-economic area is not part of main topics of interest.*
Technological area	✓ Eye-tracking devices that sense stress levels associated with cognitive load – theoretically identifying when learners have achieved a level of competency with new material; ✓ Augmented reality systems that superimpose textbooks, media, or systems and components to: o Replace air traffic controller's paper flight strips with a digital presentation of the information superimposed on their workspace; o Present maintenance personnel with a digital view of systems that may not be visible because they are obstructed by covers or other components; o Display the name and preferences of passengers to cabin crew as they walk through the cabin; and o Generate a digital representation of the ideal approach path for pilots. ✓ Proactive safety management programmes using cluster analysis on routine operational data from Flight Data Recorders to identify anomalies at specific airports and assign training content; ✓ Machine-driven learning algorithms that continually analyse data from simulated and line-operation scenarios to understand individual training needs and allow individuals to see and understand where their performance is relative to the norm; ✓ Recruitment and selection practices based on the comparison of applicant attributes against competencies demonstrated by top-performing employees through predictive analytics.
Transport planning area	*Since EATEO main purpose is aviation training and education the transport planning area is not part of main topics of interest.*

Table 35: EATEO primary and secondary stakeholders

EATEO Primary stakeholders	EATEO Secondary stakeholders

EATEO Primary stakeholders	EATEO Secondary stakeholders
✓ Research centres and universities ✓ Governmental departments of civil aviation ✓ Aviation associations ✓ Aviation technology services companies	✓ Aviation industry ✓ Policy makers (international and national level) ✓ Citizens

WEGEMT

WEGEMT aims to update and extend the skills, knowledge and competence of practising engineers and postgraduate students working at an advanced level in marine technology and related sciences.

WEGEMT achieves this aim by encouraging universities to be associated with it for them to work collectively as a network, and to actively collaborate in relevant initiatives. WEGEMT considers collaborative R&D, E&T at an advanced level, and the exchange and dissemination of information, as activities which further the aim of the Association.

[Source: WEGEMT website]

The core business of WEGEMT is represented by a set of services in the field of maritime technology and related sciences that include research and training project management, the coordination and delivery of high-quality training events, seminars and workshops, and the supply of qualified experts for project participation or evaluation.

WEGEMT dynamically fosters the involvement of its associates in innovative projects able to generate synergies, value added and industrial needs fulfilment.

The following tables summarise the main WEGEMT research trends (Table 36) and topics of interest clustered by area of competence (Table 37).

Table 36: WEGEMT main research trends

WEGEMT research trends
✓ Knowledge base proliferation on maritime themes ✓ Updating and outspreading skills and competence of practicing engineers and postgraduate students on marine technology and related sciences ✓ Initiatives supporting marine industries and education

Table 37: Main WEGEMT topics clustered by competence area

Competence area	Main WEGEMT topics
Business modelling area	✓ Digital technologies to change business models
Environmental area	✓ Exploitation of alternative fuels and renewable energy sources ✓ Green retrofitting ✓ Management of energy supply and demand by storing the energy ✓ Decontamination and recycling of decommissioned vessels
Legal/Regulatory area	*Since WEGEMT main focus is on research and training initiatives in the field of marine technology and related sciences the legal/regulatory area is not part of main topics of interest.*
Socio-economic area	✓ Increase attractiveness of maritime careers ✓ Enhancing visibility and promoting the role of women in the shipbuilding sector
Technological area	✓ Vessel automation, vessel autonomy and advanced robotics ✓ 3D Printing to create a physical product ✓ Smart grid & smart sensors
Transport planning area	✓ Intermodal Transport (Short Sea Shipping, Inland Shipping, Deep Sea Shipping)

Table 38: WEGEMT primary and secondary stakeholders

WEGEMT Primary stakeholders	WEGEMT Secondary stakeholders
✓ Research centres and universities ✓ Researchers and students ✓ Commercial and logistics industry players	✓ Policy makers ✓ Transport networks ✓ Public authorities

4.3 Public Authorities

As the public sector is an important driver in supporting a market transformation towards innovative transport solutions, and considered that it is of crucial importance to link up public bodies at national, regional and local level for reaching a coherent transformation driven from the local level, public authorities have been considered as third main actors' category. In addition to the finding already gathered from different type of resource data involving this group as described previously in this document, to assess their main areas of interest and research trend topics, the ERA-NET programme has also been investigated.

Within the so-called European Research Area (ERA) – the system of scientific research programs integrating the scientific resources of the European Union – the ERA-NET scheme aims at developing and consolidating the coordination of national and regional research programmes. Under this scheme, national and regional authorities are asked to point out research programmes they wish to conduct or open up together.

During different Framework Programmes the main attention and purpose of ERA-NET scheme changed. In particular, in FP6 ERA-NET actions gave support for actors implementing public research programmes to coordinate their activities, such as joint activities by means of joint calls for transnational proposals.

On the other hand, during FP7, ERA-NET Plus actions offered additional EU financial support to complement research funding of a single joint call for proposals between national and/or regional programmes.

Finally, the ERA-NET Cofund under Horizon 2020 has combined the former ERA-NET and ERA-NET Plus into a single instrument with the fundamental and mandatory aspect of implementing one significant call with complement funding deriving from the Commission. It can be therefore considered as a support for public-public partnerships (P2Ps) to rise the share of funding that Member States jointly commit to challenge driven research and innovation plans.

Hence, over the years, the main objective of ERA-NETs has been to move from the funding of networks to the top-up funding of single joint calls for transnational research and innovation in areas chosen as the ones having high European benefit and relevance for Horizon 2020. This with the aim of overcoming the 'intermediate knowledge products' of cooperation to more radical shifts, coordinating and facilitating community establishment and evolution, defining agendas and organising the European research and innovation framework.

From 2004 to 2014, 359 joint calls have been carried out with more than 3,400 projects funded. In addition, under the transport theme, the average number of participating countries in a joint initiative has been equal to 7.5[8]. Furthermore, in this thematic area there

[8] "The ERA-NET scheme from FP6 to Horizon 2020" – Report on ERA-NETs, their calls and the experiences from the first calls under Horizon 2020, Directorate-General for Research and Innovation, October 2014.

has been the prevalence of public-private partnerships (PPPs), while P2Ps have been implemented only in few cases.

In this framework, it is worth noting the existing synergy with the aim of partnerships having an interest in sustainable transport, particularly in cities, such as JPI Urban Europe and EIP for smart cities and communities. Moreover, the close relations with the long standing European Technology Platforms in this area can be retraced to the past implementation of PPPs, like Green Vehicles (EGVI), Shift2 Rail and CleanSky (Figure 61).

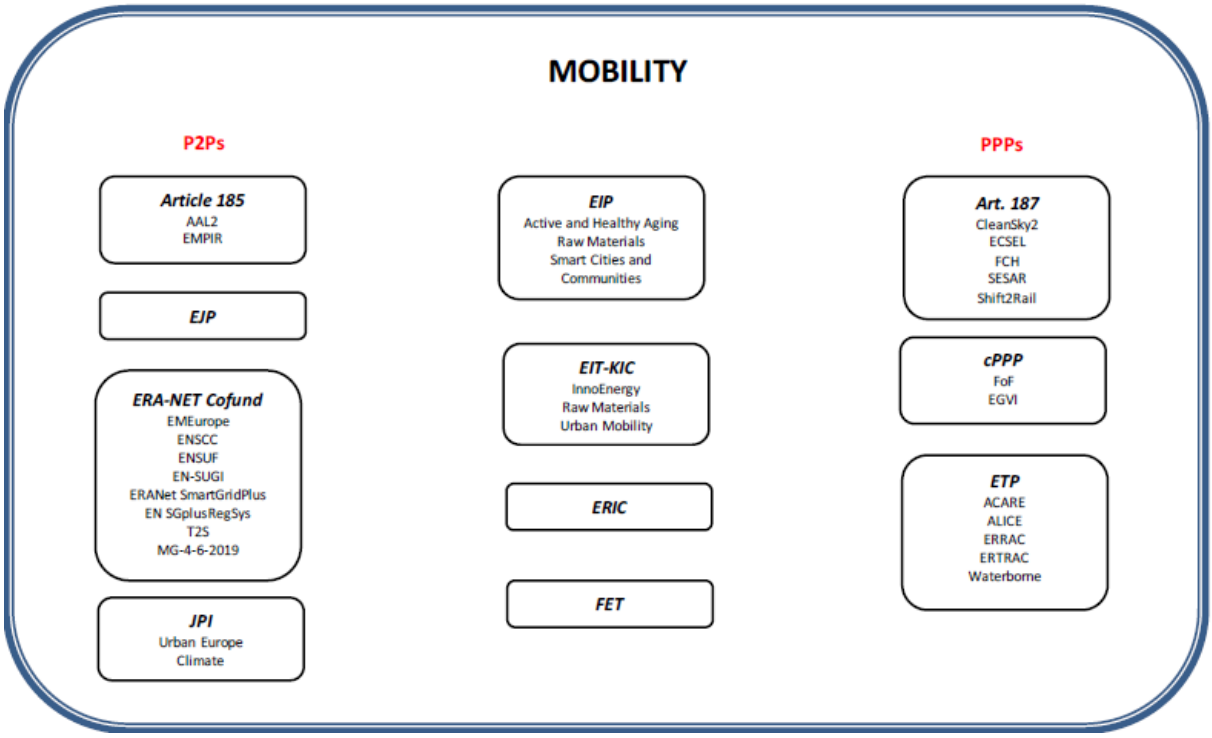

Figure 61: Partnerships and networks related to the Cluster 'Mobility' of Horizon Europe ***[Source: H2020 Partnership Landscape and its relevance for Horizon Europe –Cluster 'Climate, Energy and Mobility', ERA-LEARN Discussion paper]***

The following tables summarise the main research trends (Table 39) and topics of interest clustered by area of competence (Table 40) regarding public authorities.

Table 39: Main research trends of initiative and projects involving public authorities

Main research trends
✓ Communities and Cities ✓ Industrial Competitiveness in Transport ✓ Clean Transport and Mobility ✓ Smart Mobility ✓ Energy Storage ✓ Industrial Competitiveness in Transport

Table 40: Main topics of initiatives and projects involving public authorities clustered by competence area

Competence area	Main topics
Business modelling area	✓ City/district/mobility systems ✓ Digital network and traffic management ✓ Connected cooperative and automated mobility systems and services
Environmental area	✓ Electrification of all transport modes ✓ Sustainable new fuels and new smart vehicles, vessels and aircraft ✓ Reducing the impact of mobility ✓ Technologies including liquid and gaseous renewable fuels ✓ Batteries and EU value chain ✓ Low zero-carbon hydrogen including fuel cells
Legal/Regulatory area	✓ Single European Sky
Socio-economic area	✓ Quality of life for the citizens ✓ Safe mobility,
Technological area	✓ Merging of physical and digital design ✓ Vehicle/vessel/aircraft concepts and design ✓ On-board technologies and sub-systems ✓ New materials, techniques and methods ✓ Infrastructure ✓ maintenance, regeneration and upgrading ✓ Electrification of all transport modes ✓ Single European Sky ✓ Rail technologies and operations ✓ Connected cooperative and automated mobility systems and services
Transport planning area	✓ Urban planning, infrastructure and systems ✓ Digital network and traffic management

Table 41: Primary and secondary stakeholders of initiative and projects involving public authorities

Primary stakeholders	Secondary stakeholders
✓ Public authorities ✓ Research centres and universities ✓ Commercial and logistics industry players ✓ Transport networks ✓ Policy makers	✓ Researchers and students ✓ NGOs and community organisations ✓ Citizens

5 Overall assessment by competence area

After having investigated different type of sources regarding scientific search and outlined the profile of the main actors' categories, it is possible to get a quite complete overview of each of the six area of competence considered.

5.1 Business modelling area

Concerning the business modelling area, policy makers, public authorities, transport networks and commercial and logistics transport players resulted to be the most influencing actors having interest and power to support research questions of scientific research. The same interest but with lower influencing power is owned by research centres and universities.

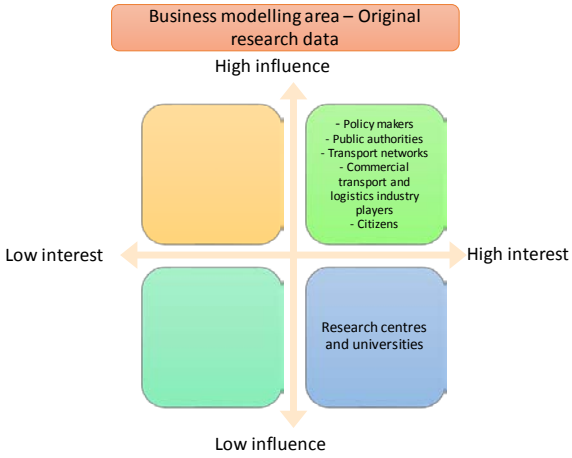

Figure 62: Stakeholder matrix for business modelling area – original research data sources investigated

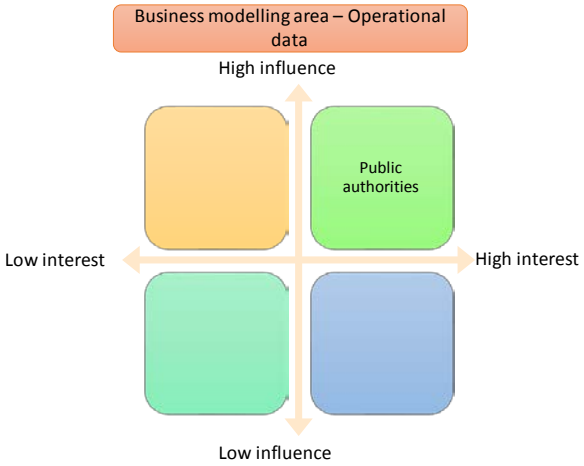

Figure 63: Stakeholder matrix for business modelling area – operational data directly related to research sources investigated

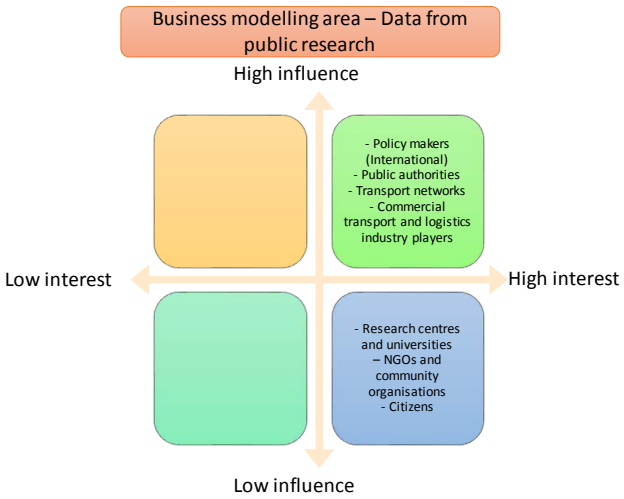

Figure 64: Stakeholder matrix for business modelling area – data from published transport research sources investigated

Taking into account as the main research and investigation instruments the appraisal of scientific sources together with the analysis of the three main actors' categories considered, the evolution of scientific production and related research questions, within the business modelling area, is characterised by a focus that has passed from solving problems such as increased traffic demand, transport efficiency and modal shift towards a growing interest for innovative commercial models also using digital technologies and fostering seamless and shared mobility together with value creation with a focus on cross-cutting issues, user needs and people and goods services integration.

Table 42: Business modelling area – Research trends over decades for different type of research data

	FP5	FP6	FP7	H2020
Original research data	✓ Growing of mobility demand	✓ Increase capacity of infrastructure	✓ Mobility integration	✓ Innovative freight delivery systems
Operational data	✓ Increased efficiency ✓ Effective transport management system ✓ Traffic congestion	✓ Increased efficiency ✓ Effective transport management system ✓ Traffic congestion	✓ Increased efficiency ✓ Effective transport management system ✓ Traffic congestion	✓ Resilient transport systems ✓ Safety and security ✓ Increased efficiency ✓ Effective transport management system ✓ Traffic congestion
Data from public research	✓ Effective transport management system ✓ Development of critical technologies ✓ Economic development ✓ Social constrains ✓ Technological prospects	✓ Interoperability ✓ Integration with other transport modes ✓ Competitive transport ✓ Innovative freight logistics services ✓ Dedicated infrastructure ✓ Security	✓ Mobility services for people and goods ✓ Navigation and control systems for optimised planning and routing ✓ Mobility integration ✓ Innovation and competitiveness ✓ Private-public partnership ✓ Vulnerable road users ✓ Emerging technologies ✓ Modal shift ✓ Fully integrated management systems	✓ Competitiveness ✓ Forward-looking activities ✓ Demographic trends ✓ Dependence on fossil fuels ✓ Innovative freight delivery systems ✓ Multi-disciplinary collaborations ✓ New materials and processes ✓ Adverse health effects ✓ Safety and security

5.2 Environmental area

Research centres and universities, public authorities, commercial transport and logistics industry players and policy makers resulted to have the highest interest and influence within the environmental area, followed by NGOs and community organisations together with citizens for which the theme is relevant even if they do not have much influence on it. On the other side, transport networks seemed to be less interested in environmental topics even if they potentially have influence on them.

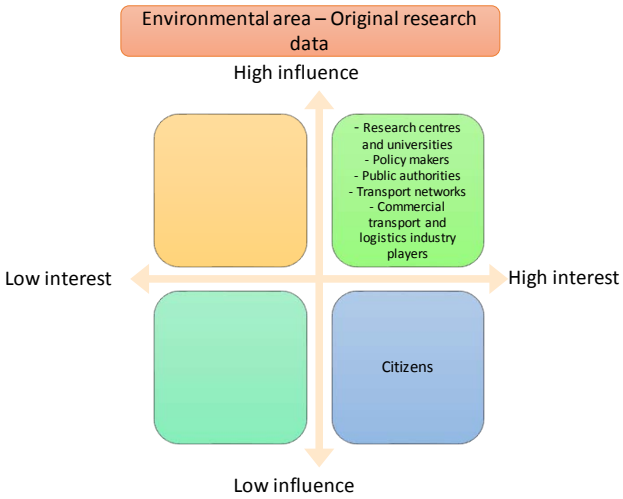

Figure 65: Stakeholder matrix for environmental area – original research data sources investigated

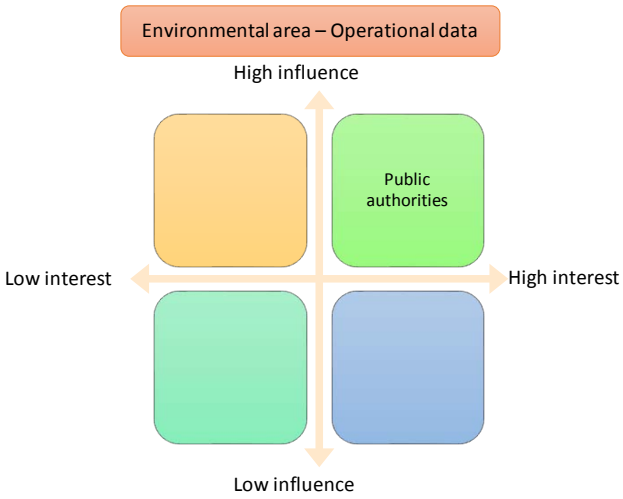

Figure 66: Stakeholder matrix for environmental area – operational data directly related to research sources investigated

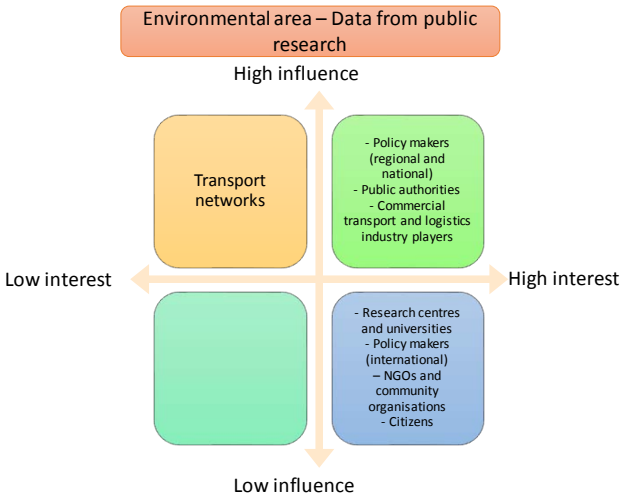

Figure 67: Stakeholder matrix for environmental area – data from published transport research sources investigated

Considering the environmental area, the evolution of scientific production and related research questions sees an increasing interest for ecological and green aspect of transport. Research questions have in fact gone from a more generic approach to tackle urban pollution and improve quality of life to a more committed engagement on environmental protection and monitoring, blue growth development, alternative energies and propulsions also in light of zero emissions targets, better understanding of the impact of land use and increase re-use and recycling.

Table 43: Environmental area – Research trends over decades for different type of research data

	FP5	FP6	FP7	H2020
Original research data	✓ Sustainable urban systems ✓ Urban environment ✓ Quality of life	✓ Alternative fuels, environmental efficiency ✓ Vehicle efficiency	✓ Emissions reduction Eco-innovation ✓ Emissions abatement ✓ Alternative and cleaner fuels ✓ Emissions reduction ✓ emissions abatement ✓ Eco-innovation ✓ Emissions reduction ✓ Energy consumption reduction ✓ Fully integrated management systems ✓ Emissions abatement ✓ Alternative fuels ✓ Green cars ✓ Alternative and cleaner fuels ✓ Innovative forms of urban transport	✓ Dependence on fossil fuels ✓ Electric vehicles
Operational data	✓ Urban pollution ✓ Urban congestion	✓ Polluting transport	✓ Eco-innovation ✓ Congestion reduction	✓ Zero emissions
Data from public research	✓ Urban pollution ✓ Emissions reduction ✓ Environmental constrains ✓ Economic development ✓ Technological prospects ✓ Development of critical technologies	✓ Environmental friendly transport ✓ Vehicle efficiency ✓ Clean vehicle fleets ✓ Competitive transport ✓ Payment systems ✓ Security	✓ Emissions abatement ✓ Alternative and cleaner fuels ✓ Innovation and competitiveness ✓ Co-modality ✓ Intermodality	✓ Forward-looking activities ✓ Dependence on fossil fuels ✓ Innovative powertrain ✓ Mitigation of climate change ✓ Zero emissions ✓ Adverse health effects

	FP5	FP6	FP7	H2020
	✓ Growing of mobility demand ✓ Increased efficiency ✓ Quality of transport system and services ✓ Effective transport management system	✓ Polluting transport ✓ Accessibility ✓ Increase capacity of infrastructure	✓ Eco-innovation ✓ More comfortable transport ✓ Vulnerable road users ✓ Time-to-market decrease ✓ Emerging technologies ✓ Mobility integration ✓ Energy consumption reduction ✓ Mobility services for people and goods ✓ Navigation and control systems for optimised planning and routing ✓ More efficient transport ✓ Fully integrated management systems ✓ Innovative forms of urban transport ✓ Private-public partnership ✓ Eco-innovation ✓ Co-modality ✓ Emerging technologies ✓ Energy consumption reduction ✓ Zero emissions	✓ Safety and security ✓ Interoperability of transport systems ✓ Multi-disciplinary collaborations ✓ New materials and processes ✓ Common standards and procedures ✓ Air quality ✓ Seamless mobility ✓ Demographic trends ✓ Resilient transport systems ✓ Automated Road Transport ✓ Competitiveness ✓ Personalised/smart services ✓ Inclusive and affordable transport ✓ Adverse health effects ✓ Innovative freight delivery systems ✓ Common standards and procedures ✓ Multi-disciplinary collaborations ✓ Electric vehicles ✓ Interoperability of transport systems ✓ New materials and processes

	FP5	FP6	FP7	H2020
				✓ Resilient transport systems ✓ Shared mobility for people and goods

5.3 Legal/Regulatory area

As expected, the main actors' groups influencing transport legal and regulatory aspects resulted to be both policy makers and public authorities, with the participation of transport networks and commercial and logistics industry players.

Research centres and universities together with researchers and students, on the other hand, have little influence on legal and regulatory matters.

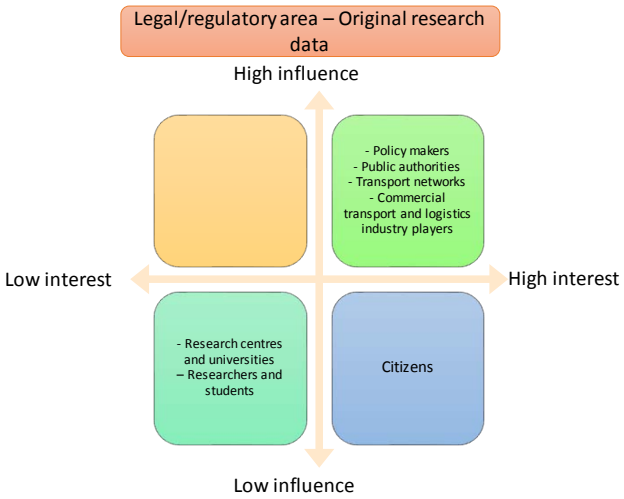

Figure 68: Stakeholder matrix for legal/regulatory area – original research data sources investigated

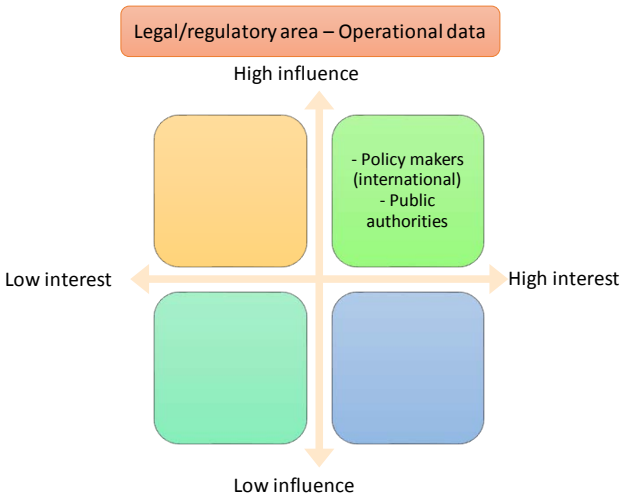

Figure 69: Stakeholder matrix for legal/regulatory area – original research data sources investigated

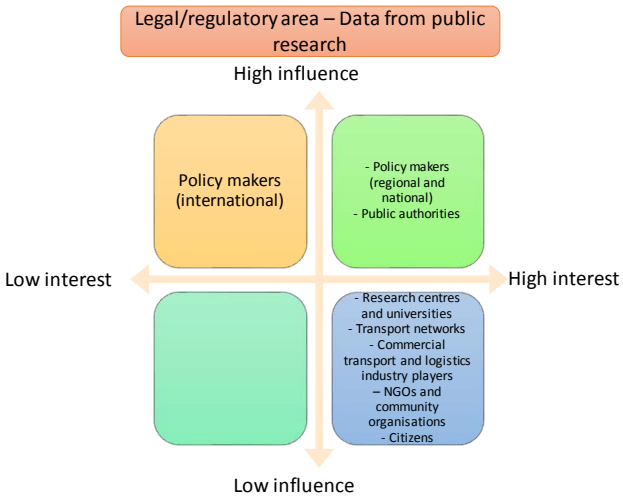

Figure 70: Stakeholder matrix for legal/regulatory area – data from published transport research sources investigated

In the context of legal and regulatory area, the progression of scientific production and related research questions is depicted by a course started from the management of barriers and legal issues and addressing incentives to arrive at analysing more in depth policy and regulatory needs, intermodal technical interoperability, regulatory frameworks allowing for a global level playing field for Europe to compete in the global market, policies for information and data sharing and ownership, PPPs and P2Ps, and a unified language for European transport operations.

Table 44: Legal/Regulatory area – Research trends over decades for different type of research data

	FP5	FP6	FP7	H2020
Original research data	✓ Legal barriers ✓ Legal issues	✓ Transport regulation ✓ Integration with other transport modes ✓ Collective transport ✓ Regulatory framework ✓ Competitive transport ✓ Policy instruments ✓ Traffic Law Enforcement policies ✓ Action plan ✓ Guidance and traffic management	✓ Innovation and competitiveness ✓ Emerging technologies	✓ Air quality
Operational data	✓ Incentives	✓ Safety and security ✓ Zero fatalities	✓ Safety and security ✓ Zero fatalities	✓ Safety and security ✓ Fatalities ✓ Increased efficiency ✓ Design integration ✓ Technological prospects ✓ Forward-looking activities ✓ Innovative freight delivery systems ✓ Blockchain
Data from public research	✓ System competitiveness ✓ Growing of mobility demand ✓ Cooperation between manufacturers ✓ Safety constrains ✓ Increasing safety ✓ Social constrains	✓ Competitive transport ✓ Innovative freight logistics services ✓ Interoperability ✓ Integration with other transport modes ✓ Environmental friendly transport	✓ Emerging technologies ✓ Emissions abatement ✓ Eco-innovation ✓ Innovation and competitiveness ✓ Private-public partnership ✓ More efficient transport ✓ Vulnerable road users	✓ Competitiveness ✓ Dependence on fossil fuels ✓ Forward-looking activities ✓ Multi-disciplinary collaborations ✓ Common standards and procedures ✓ Seamless mobility

	FP5	FP6	FP7	H2020
		✓ Vehicle efficiency ✓ Innovative freight logistics services ✓ Guidance and traffic management ✓ Security ✓ Navigation services	✓ Mobility services for people and goods ✓ Fully integrated management systems ✓ Modal shift ✓ Co-modality	✓ Demographic trends ✓ New materials and processes ✓ Safety and security

5.4 Socio-economic area

Many actors resulted to be both interested and influencing when considering the socio-economic area. In particular, public authorities, commercial transport and logistics industry players and transport network appear to be the main players in the field followed by research centres and universities. On the contrary, transport networks seemed to have no particular interest in such an area.

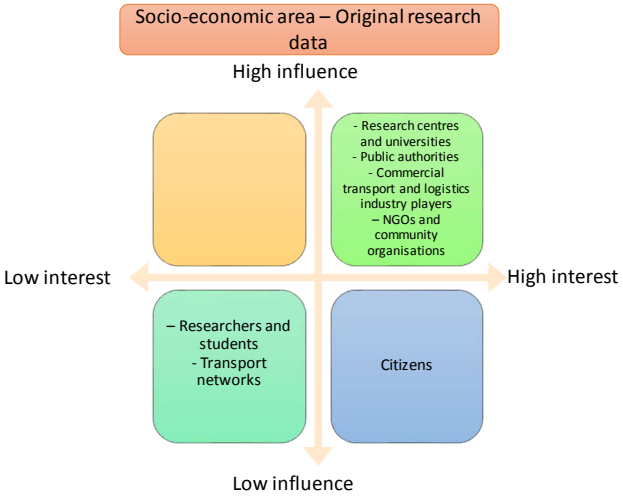

Figure 71: Stakeholder matrix for socio-economic area – original research data sources investigated

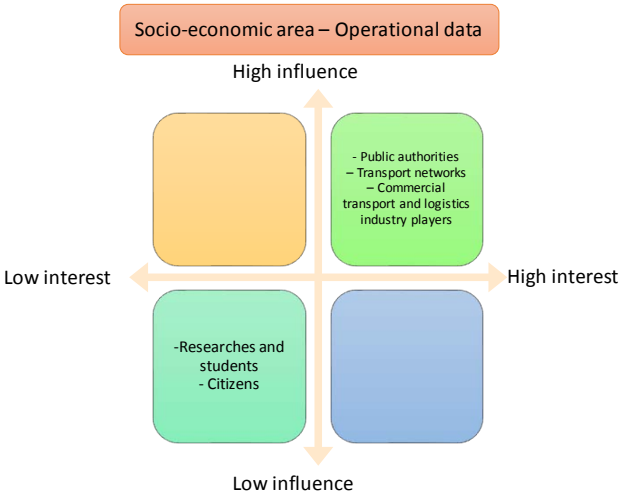

Figure 72: Stakeholder matrix for socio-economic area – original research data sources investigated

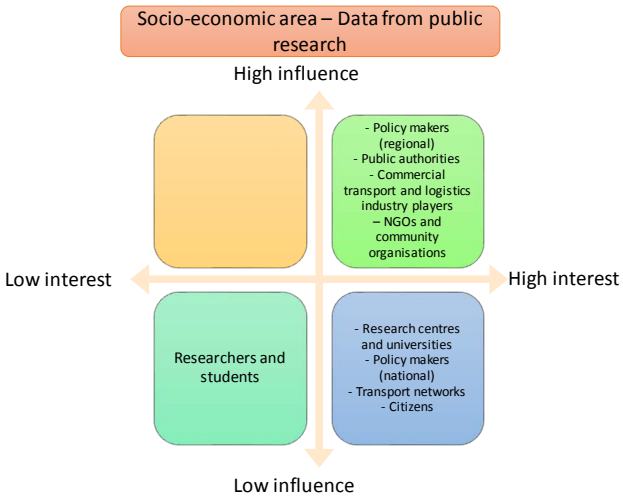

Figure 73: Stakeholder matrix for socio-economic area – data from published transport research sources investigated

Within the socio-economic area, the tendency of scientific production and related research questions shows a transition from topics and issues related to safety, social and economic constrains, public participation and improvement of collective transport for better accessibility and social inclusion to user awareness, market liberalisation, circular economy in transport, investments in EU innovations and transport capacity, supply chain cost reduction, travel behaviour, ageing society, pricing and externalities and service economics.

Table 45: Socio-economic area – Research trends over decades for different type of research data

	FP5	FP6	FP7	H2020
Original research data	✓ Safety constrains ✓ Social constrains ✓ Economical constrains	✓ Transport pricing ✓ Collective transport	✓ Public participation ✓ Job creation	✓ Personalised services ✓ Inclusive and affordable transport
Operational data	✓ Social impacts ✓ Economic impacts	✓ Accessibility ✓ Security	✓ Vulnerable road users	✓ Safety and security
Data from public research	✓ Urban pollution ✓ Emissions reduction ✓ Environmental constrains ✓ Economic development ✓ Technological prospects ✓ Development of critical technologies ✓ Employment ✓ System competitiveness ✓ Effective transport management system ✓ Growing of mobility demand ✓ Sustainable use of resources	✓ Competitive transport ✓ Payment systems ✓ Security ✓ Mobility services for people and goods ✓ Innovation and competitiveness ✓ Clean maintenance ✓ Dedicated infrastructure ✓ Environmental friendly transport ✓ Vehicle efficiency ✓ Innovative freight logistics services ✓ Collective transport ✓ Integration with other transport modes	✓ More comfortable transport ✓ Increased use of public transport ✓ Emerging technologies ✓ Innovation and competitiveness ✓ More efficient transport ✓ Emissions abatement ✓ Eco-innovation ✓ Co-modality ✓ Mobility integration ✓ Innovative forms of urban transport ✓ Private-public partnership ✓ Public participation	✓ Competitiveness ✓ Forward-looking activities ✓ Multi-disciplinary collaborations ✓ Dependence on fossil fuels ✓ Interoperability of transport systems ✓ Adverse health effects ✓ New materials and processes ✓ Innovative powertrains ✓ Resilient transport systems ✓ Safety and security ✓ Common standards and procedures ✓ Demographic trends

5.5 Technological area

The main interest and influence within the technological area is showed by research centres and universities and commercial transport and logistics industry players followed by transport network and policy makers, while the role of public authorities is mainly linked to operational data gathered within this area.

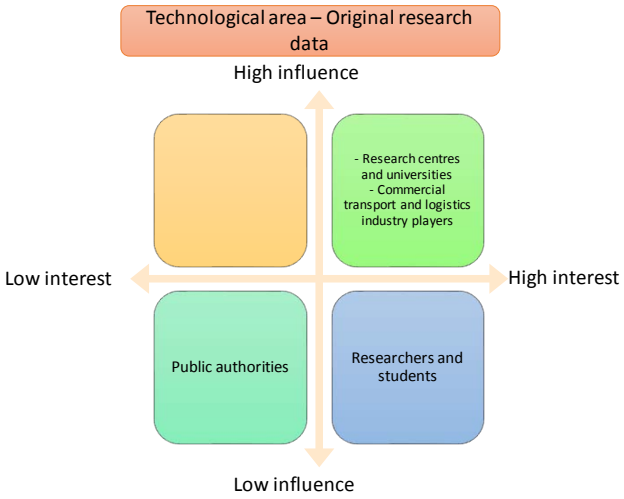

Figure 74: Stakeholder matrix for technological area – original research data sources investigated

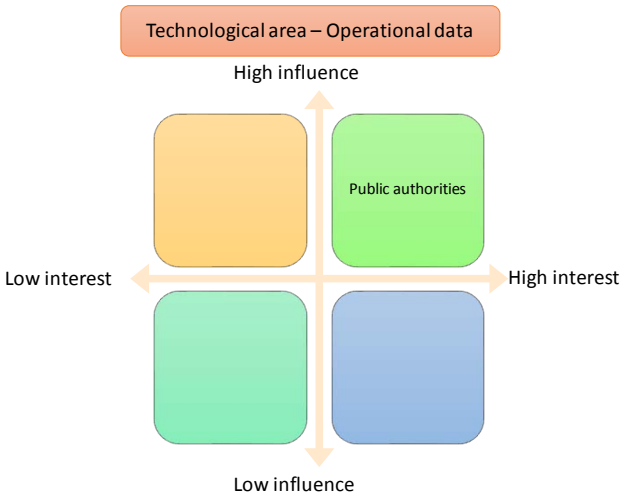

Figure 75: Stakeholder matrix for technological area – original research data sources investigated

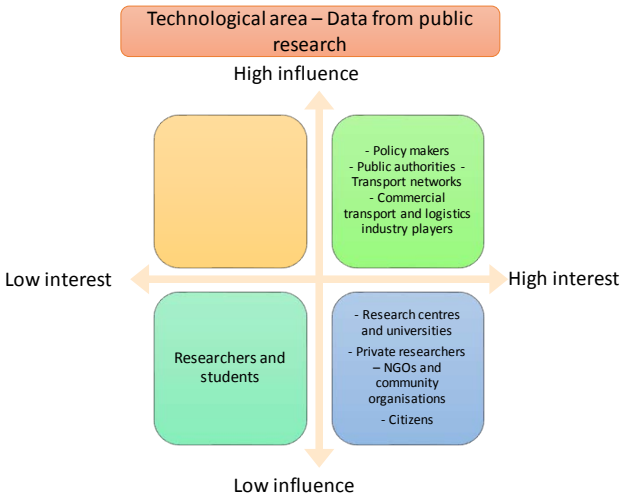

Figure 76: Stakeholder matrix for technological area – data from published transport research sources investigated

Quality of transport system and services together with traffic congestion related issues and the advancement of critical technologies constitute the starting point for the evolution of scientific production and related research questions within the technological area. During decades topics evolved towards themes dealing with smart and connected transport, services provision from hub to hub, digital awareness and resilience, automated vehicles, big data, IoT and blockchain, physical security, new space-based applications, cooperative systems, new materials, augmented reality systems and smart grids and sensors.

Table 46: Technological area – Research trends over decades for different type of research data

	FP5	FP6	FP7	H2020
Original research data	✓ Quality of transport system and services ✓ Development of critical technologies ✓ Quality of life ✓ Traffic congestion ✓ Technological prospects ✓ Safety constrains ✓ Increasing safety ✓ Increased efficiency	✓ Competitive transport ✓ Traffic Law Enforcement policies ✓ Competitive transport ✓ Guidance and traffic management	✓ Resilient and responsive infrastructure ✓ Safety and security ✓ Safety Management ✓ Recover under abnormal conditions ✓ Information services ✓ Intermodal travel information ✓ Electric vehicles ✓ Public-private partnerships ✓ Green cars ✓ Innovation and competitiveness ✓ Innovative forms of urban transport ✓ Increased use of public transport ✓ More efficient transport ✓ Energy consumption reduction ✓ Eco-innovation ✓ Alternative and cleaner fuels ✓ Mobility integration ✓ Automated urban vehicles	✓ Innovative freight delivery systems ✓ Resilient transport systems ✓ Seamless mobility ✓ Safety and security ✓ Personalised/smart services ✓ Zero fatalities ✓ Big Data Analysis tool ✓ Data Sharing ✓ Robust transport systems ✓ ATM system ✓ Air quality ✓ Automated Road Transport ✓ Electric vehicles ✓ Innovative powertrains
Operational data	✓ Information technology	✓ Vehicle location	✓ Vehicle to vehicle	✓ Safety and security ✓ Resilient transport systems
Data from public	✓ Technological prospects	✓ Environmental friendly	✓ Emissions abatement	✓ Dependence on fossil fuels

	FP5	FP6	FP7	H2020
research	✓ Development of critical technologies ✓ Increasing safety ✓ Safety constrains ✓ Environmental friendly transport	transport ✓ Vehicle efficiency ✓ Clean vehicle fleets ✓ Rational use of motorised transport ✓ Clean maintenance ✓ Integration with other transport modes ✓ Innovative freight logistics services ✓ Security ✓ Interoperability ✓ Dedicated infrastructure ✓ Guidance and traffic management	✓ Alternative and cleaner fuels ✓ Innovation and competitiveness ✓ Emerging technologies ✓ Advanced driver assistance systems ✓ Emerging technologies ✓ Intelligent Transport Systems ✓ Private-public partnership ✓ Navigation and control systems for optimised planning and routing ✓ More efficient transport ✓ Safety and security ✓ Electric vehicles ✓ Mitigation of climate change ✓ Zero emissions ✓ Gas emission	✓ Mitigation of climate change ✓ Forward-looking activities ✓ Innovative powertrain ✓ Common standards and procedures ✓ Safety and security ✓ New materials and processes ✓ Adverse health effects ✓ Interoperability of transport systems ✓ Multi-disciplinary collaborations ✓ Competitiveness ✓ Personalised/smart services ✓ Inclusive and affordable transport ✓ Robust transport systems ✓ Zero emissions ✓ Resilient transport systems ✓ Innovative freight delivery systems ✓ Electric vehicles ✓ Automated Road Transport ✓ Personalised/smart services

5.6 Transport planning area

Public authorities, transport networks and policy makers represent the actors' categories with most relevant interest and influence when dealing with the transport planning area followed by commercial transport and logistics industry players and research centres and universities.

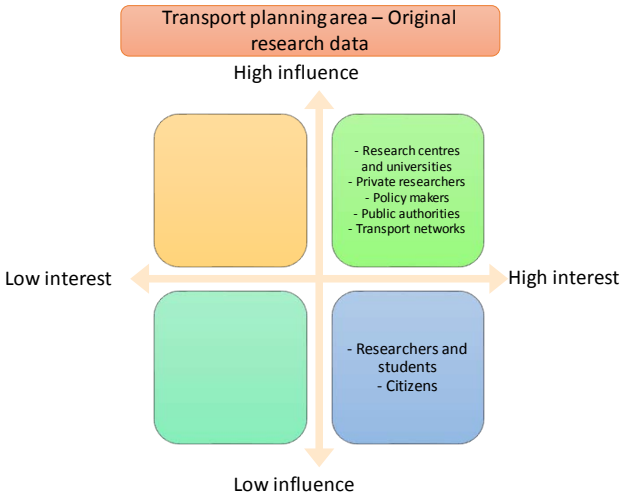

Figure 77: Stakeholder matrix for transport planning area – original research data sources investigated

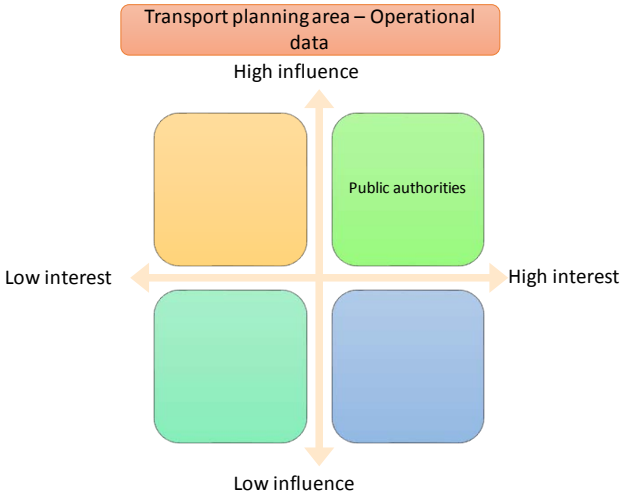

Figure 78: Stakeholder matrix for transport planning area – original research data sources investigated

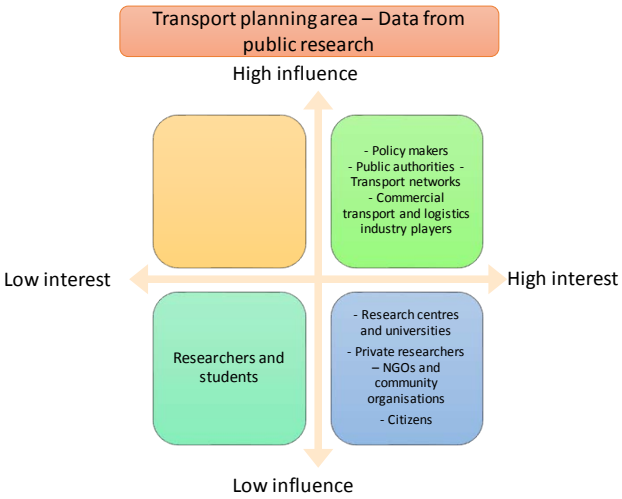

Figure 79: Stakeholder matrix for transport planning area – data from published transport research sources investigated

When considering the transport planning area, the development of scientific production and related research questions showed to have its foundation on topics and issues mainly dealing with traffic congestion, emissions reduction and safety increase. Then, the evolution that has characterised the last decades until today has seen a change towards questions regarding accessibility, smart city planning, network efficiency, interoperability within modes, integrated and resilient transport systems and risk analysis and management.

Table 47: Transport planning area – Research trends over decades for different type of research data

	FP5	FP6	FP7	H2020
Original research data	✓ Quality of life	✓ Navigation services ✓ Payment systems	✓ Modal shift ✓ Congestion reduction ✓ Transport network	✓ Resilient transport systems ✓ Inclusive and affordable transport ✓ Demand profile ✓ Mobility Metrics ✓ Innovative freight delivery systems ✓ Personalised/smart services ✓ On-demand public transport
Operational data	✓ Emissions reduction ✓ Increasing safety ✓ Traffic congestion ✓ Automatic (ATC)	✓ Emissions reduction ✓ Increasing safety ✓ Traffic congestion ✓ ATC	✓ Emissions reduction ✓ Increasing safety ✓ Traffic congestion ✓ ATC	✓ Common standards and procedures ✓ Interoperability of transport systems ✓ Seamless mobility ✓ Inclusive and affordable transport ✓ Demographic trends ✓ Zero fatalities ✓ Resilient transport systems ✓ Accident& Incident Report ✓ Forecasts ✓ Safety and security ✓ Emissions reduction ✓ Increasing safety ✓ Traffic congestion ✓ ATC ✓ Innovative freight delivery

	FP5	FP6	FP7	H2020
				systems ✓ On-demand public transport
Data from public research	✓ Urban pollution ✓ Environmental constrains ✓ Safety constrains ✓ Economic development ✓ Technological prospects ✓ Development of critical technologies ✓ Social constrains ✓ Traffic congestion	✓ Dedicated infrastructure ✓ Competitive transport ✓ Mobility services for people and goods ✓ Innovation and competitiveness ✓ Competitive transport ✓ Mobility services for people and goods ✓ Accessibility Integration with other transport modes ✓ Security ✓ Information services	✓ Navigation and control systems for optimised planning and routing ✓ Intelligent Transport Systems ✓ Intermodality ✓ Emerging technologies ✓ Innovation and competitiveness ✓ More efficient transport ✓ Vulnerable road users ✓ Mobility services for people and goods ✓ Mobility integration ✓ Emerging technologies ✓ Eco-innovation ✓ Shared mobility ✓ Zero emissions	✓ Safety and security ✓ Air quality ✓ Dependence on fossil fuels ✓ Mitigation of climate change ✓ Common standards and procedures ✓ New materials and processes ✓ Forward-looking activities ✓ Adverse health effects ✓ Multi-disciplinary collaborations ✓ Competitiveness ✓ Innovative freight delivery systems ✓ Seamless mobility ✓ Zero emissions ✓ Demographic trends ✓ Innovative powertrains ✓ Automated Road Transport ✓ Robust transport systems

6 Conclusions

To increase research quality, enhance cooperation, encourage public access to scientific results, accelerate the research process and carry out a more open research appraisal are the main objectives of Open Science[9]. As also highlighted by the EC, researchers can profit from Open Science to improve the excellence of curiosity-driven research, improving scientific progress at both European and global scale[10] . Additionally, Open Science is able to allow policy makers, funding bodies and research institutions having a critical view on key insights such as goals that researchers have to seek, methods and procedures to better assess and spread research results and the ways to assist research and integrate it within society[11].

Moreover, it is worth noting that Open Science embraces the whole research cycle, from conceptualization, through analysis to publication. This is why is of crucial importance to involve with in a coordinated manner all different stakeholders, including policy makers, industry, public authorities and research organisations. By doing that it will then be possible to switch from the standard practice of publishing research results to data and knowledge sharing at an earlier stage of the process.

In this framework, a dialogue and cooperation among all different stakeholders should be fostered to contribute to sustainable development objectives and societal challenges. In particular, as resulted from the appraisal carried out within this document, transport research and industry representatives together with public authorities involved in transport and mobility issues are the most interested actors in that field and have to be involved through a more structured approach fostering the enhancement of Open Science in transport. This will allow for overcoming the current fragmentation of scientific production in the transport domain so that the positive impacts of research achievements can be increased and disseminated.

[9] "Open Science: One Term, Five Schools of Thought", Fecher, B. & Friesike, S. 2013.
[10] "Open Innovation, Open Science, Open to the World - A Vision for Europe", European Commission, 2016.
[11] "H2020 Policy Support. Facility, Mutual Learning Exercise on Open Science: Altmetrics and Rewards" – thematic Report on Incentives and Rewards to engage in Open Science Activities, European Commission, 2018.

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WEGEMT website (www.wegemt.com)

8 ANNEX

Table 48: Scientific resources gathered for original research data

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
FP5_1998_2002	Research activities libraries (e.g. TRIMIS, ERTICO Observatory, etc.)	Technological	Information technology	Quality of transport system and services			
FP5_1998_2002	EC funded projects	Socio-economic	Growing of mobility demand	Quality of transport system and services			
FP5_1998_2002	EC funded projects	Socio-economic	Sustainable use of resources	Increased efficiency			
FP5_1998_2002	EC funded projects	Transport planning	Traffic engineering, liveable city	Quality of life	FP5		
FP5_1998_2002	EC funded projects	Socio-economic area, technological area	Social impacts, economic impact	Economic development	Urban environment	safety constraints	social life
FP5_1998_2002	EC funded projects	Technological area	Automated transport	Development of critical technologies	Quality of transport system and services	FP5	
FP5_1998_2002	EC funded projects	Technological area	ITS applications	Quality of life	Quality of transport system and services	FP5	
FP5_1998_2002	EC funded projects	Business modelling area	Shared mobility	Growing of mobility demand	FP5		
FP5_1998_2002	EC funded projects	Technological area	Infomobility	Traffic congestion	Quality of transport system and services	Technological prospects	FP5
FP5_1998_2002	EC funded projects	Technological area	Control systems	Safety constrains	Increasing safety	FP5	
FP5_1998_2002	EC funded projects	Technological area	Process	Increased efficiency	FP5		

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
			automation				
FP5_1998_2002	EC funded projects	Socio-economic area	Economic impact	Economic development	FP5		
FP5_1998_2002	EC funded projects	Environmental	Sustainable urban systems	Urban environment	Quality of life		
FP6_2002_2006	EC funded projects	Legal/Regulatory	transport regulation	Integration with other transport modes	Collective transport		
FP6_2002_2006	EC funded projects	Socio-economic	Guidelines	Security	FP6		
FP6_2002_2006	EC funded projects	Technological	ITS applications	FP6			
FP6_2002_2006	EC funded projects	Technological	ITS applications	FP6			
FP6_2002_2006	EC funded projects	Technological	ITS applications	FP6			
FP6_2002_2006	EC funded projects	Technological	ITS applications	FP6			
FP6_2002_2006	EC funded projects	Socio-economic	ITS applications	FP6			
FP6_2002_2006	EC funded projects	Environmental area	Alternative fuels, environmental efficiency	Vehicle efficiency	Renewable fuels	environmental performance	biofuel
FP6_2002_2006	EC funded projects	Legal/Regulatory area	Regulatory framework	Competitive transport	FP6		
FP6_2002_2006	EC funded projects	Environmental	Alternative fuels, environmental efficiency	Vehicle efficiency	FP6		
FP6_2002_2006	EC funded projects	Legal/Regulatory area	Policy instruments	Traffic Law Enforcement policies	FP6		
FP6_2002_2006	EC funded projects	Legal/Regulatory area	Action plan	Competitive transport	Guidance and traffic management	FP6	
FP7_2007_ 2013	EC funded projects	Legal/Regulatory	Regulatory framework	Innovation and competitiveness	Emerging technologies		
FP7_2007_ 2013	EC funded projects	Environmental	Emissions	Eco-innovation	Emissions	Alternative and	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
			reduction		abatement	cleaner fuels	
FP7_2007_ 2013	EC funded projects	Technological	future ATM system	Resilient and responsive infrastructure	Safety and security	Safety Management	Recover under abnormal conditions
FP7_2007_ 2013	EC funded projects	Technological	ITS applications	Information services	Intermodal travel information		
FP7_2007_ 2013	EC funded projects	Technological	ITS applications	Information services	Intermodal travel information		
FP7_2007_ 2013	EC funded projects	Technological	ITS applications	Information services	Intermodal travel information		
FP7_2007_ 2013	EC funded projects	Technological	ITS applications	Information services	Intermodal travel information		
FP7_2007_ 2013	EC funded projects	Technological	ITS applications	Information services	Intermodal travel information		
FP7_2007_ 2013	EC funded projects	Technological	ITS applications	Information services	Intermodal travel information		
FP7_2007_ 2013	EC funded projects	Technological area	Electrification	electric vehicles	public-private partnerships	Green cars	
FP7_2007_ 2013	EC funded projects	Environmental	Emissions reduction	emissions abatement	Eco-innovation		
FP7_2007_ 2013	EC funded projects	Technological area	Design of vehicles	Private-public partnership	Innovation and competitiveness	Innovative forms of urban transport	Increased use of public transport
FP7_2007_ 2013	EC funded projects	Technological area	Electric vehicles, Lightweight	Green cars	Innovation and competitiveness	Innovative forms of urban transport	
FP7_2007_ 2013	EC funded projects	Technological area	Electric vehicles, hybrid vehicles, safety systems, propulsion systems	Innovation and competitiveness	More efficient transport		
FP7_2007_ 2013	EC funded projects	Environmental	Emissions reduction	Energy consumption reduction	Fully integrated management systems	Emissions abatement	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
FP7_2007_ 2013	EC funded projects	Technological area	Electric vehicles, lightweight, safety system	Innovative forms of urban transport	Green cars	Innovative forms of urban transport	
FP7_2007_ 2013	EC funded projects	Electric vehicles	Electric vehicles	More efficient transport			
FP7_2007_ 2013	EC funded projects	Environmental	Alternative fuels	Green cars	Alternative and cleaner fuels	Innovative forms of urban transport	Hydrogen vehicles
FP7_2007_ 2013	EC funded projects	Technological area	Electric vehicles, Design, Light vans	Innovation and competitiveness	Energy consumption reduction		
FP7_2007_ 2013	EC funded projects	Technological area	Design of vehicles, hybrid vehicles	More efficient transport			
FP7_2007_ 2013	EC funded projects	Technological area	Hybrid vehicles	Energy consumption reduction	Eco-innovation	Alternative and cleaner fuels	
FP7_2007_ 2013	EC funded projects	Technological area	Infomobility	Increased use of public transport	More efficient transport	Mobility integration	
FP7_2007_ 2013	EC funded projects	Technological area	Automated transport	Automated urban vehicles			
FP7_2007_ 2013	EC funded projects	Technological area	Automated transport	Automated urban vehicles			
H2020_2014_2020	University projects and initiatives	Business modelling	business model	Innovative freight delivery systems			
H2020_2014_2020	EC funded projects	Technological	Automated transport	Innovative freight delivery systems			
H2020_2014_2020	EC funded projects	Business modelling	Innovative solutions	Innovative freight delivery systems			
H2020_2014_2020	EC funded projects	Socio-economic	Innovative solutions	Internet of Things	Resilient and responsive infrastructure		
H2020_2014_2020	EC funded projects	Technological	Automated transport	Resilient transport systems	Seamless mobility		

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
H2020_2014_2020	EC funded projects	Technological	Safety systems	Resilient transport systems	Safety and security		
H2020_2014_2020	Industry and research projects and initiatives	Socio-economic	Economic impact	Competitiveness	Innovative powertrains		
H2020_2014_2020	EC funded projects	Technological	ITS applications	Innovative freight delivery systems	Personalised/smart services		
H2020_2014_2020	EC funded projects	Technological	Data analytics	Zero fatalities	Safety and security	Bid Data Analysis tool	Data Sharing
H2020_2014_2020	EC funded projects	Technological	Single European Sky ATM Research	Safety and security	Resilient transport systems	Robust transport systems	ATM system
H2020_2014_2020	EC funded projects	Transport planning	Passengers at the centre	Resilient transport systems	Inclusive and affordable transport	Demand profile	Mobility Metrics
H2020_2014_2020	EC funded projects	Socio-economic	SESAR Exploratory Research	Competitiveness	Inclusive and affordable transport	SESAR	fully monetised and quasi-cost impact measures
H2020_2014_2020	EC funded projects	Legal/Regulatory area	Regulation	Air quality			
H2020_2014_2020	EC funded projects	Transport planning	Smart supply chain	Innovative freight delivery systems	Personalised/smart services		
H2020_2014_2020	EC funded projects	Technological area	Advanced Driver Assistance Systems	Automated Road Transport	Electric vehicles	zero fatalities	
H2020_2014_2020	EC funded projects	Socio-economic area	Social innovation, social impacts, economic impact	Seamless mobility	Personalised/smart services	demographic trends	
H2020_2014_2020	EC funded projects	Technological area	Design of vehicles, safety systems	Innovative powertrains	Innovative freight delivery systems		
H2020_2014_2020	EC funded projects	Transport planning	Liveable city, transport demand	Personalised/smart services	On-demand public transport		

Table 49: Scientific resources gathered for operational data directly related to research

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
FP5_1998_2002	European public authorities	Transport planning	Safety Notices	Emissions reduction	Increasing safety	Traffic congestion	ATC
FP5_1998_2002	European public authorities	Business modelling	Cost-effectiveness and productivity for (ANSPs) in Europe	Increased efficiency	Effective transport management system	Traffic congestion	ATC
FP6_2002_2006	Other public authorities	Socio-economic	Economic impact	Competitive transport	Collective transport		
FP6_2002_2006	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP6_2002_2006	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP6_2002_2006	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP6_2002_2006	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP6_2002_2006	European public authorities	Transport planning	Safety Notices	Emissions reduction	Increasing safety	Traffic congestion	ATC
FP6_2002_2006	European public authorities	Business modelling	Cost-effectiveness and productivity for (ANSPs) in Europe	Increased efficiency	Effective transport management system	Traffic congestion	ATC
FP7_2007_ 2013	Other public authorities	Socio-economic	Economic impact	Job creation	Public participation		
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP7_2007_ 2013	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
FP7_2007_ 2013	European public authorities	Transport planning	Safety Notices	Emissions reduction	Increasing safety	Traffic congestion	ATC
FP7_2007_ 2013	European public authorities	Business modelling	Cost-effectiveness and productivity for (ANSPs) in Europe	Increased efficiency	Effective transport management system	Traffic congestion	ATC
H2020_2014_2020	National public authorities	Transport planning	Transport network	Common standards and procedures	Interoperability of transport systems		
H2020_2014_2020	Other public authorities	Transport planning	Transport network	Seamless mobility			
H2020_2014_2020	Other public authorities	Transport planning	Transport demand	Inclusive and affordable transport	Demographic trends		
H2020_2014_2020	European public authorities	Socio-economic	Social impacts	Safety and security	Zero fatalities		
H2020_2014_2020	National public authorities	Technological	Aviation safety	Safety and security	Resilient transport systems		
H2020_2014_2020	European public authorities	Socio-economic	Aerial Accident Victims	Demographic trends	Resilient transport systems	Commercial Air Transport	
H2020_2014_2020	National public authorities	Environmental	Aviation Weather Service	Zero emissions		Aviation Digital Data Service (ADDS)	
H2020_2014_2020	National public authorities	Transport planning	Data & Research	Zero fatalities	Resilient transport systems	Accident& Incident Report	Forecasts

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
H2020_2014_2020	National public authorities	Technological	Aviation Statistics	Safety and security	Resilient transport systems		
H2020_2014_2020	National public authorities	Business modelling	Resilient transport systems	Safety and security	Aircraft Traffic	Passengers	
H2020_2014_2020	Other public authorities	Transport planning	IATA Safety Report	Safety and security	Aircraft Traffic	Passengers	
H2020_2014_2020	National public authorities	Legal/Regulatory	Safeguarding of Aerodromes	Safety and security	Fatalities	Increased efficiency	Safeguarding of Aerodromes
H2020_2014_2020	National public authorities	Legal/Regulatory	Balloon Notices	Safety and security	Zero fatalities	Passengers	Active Balloon Notices
H2020_2014_2020	National public authorities	Legal/Regulatory	Airworthiness	Safety and security	Zero fatalities	Passengers	ANs
H2020_2014_2020	National public authorities	Legal/Regulatory	General Aviation pilots	Safety and security	Zero fatalities		CAP1535
H2020_2014_2020	National public authorities	Legal/Regulatory	Airworthiness	Safety and security	Zero fatalities	Passengers	Emergency ADs
H2020_2014_2020	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
H2020_2014_2020	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
H2020_2014_2020	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS
H2020_2014_2020	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS 2017
H2020_2014_2020	National public authorities	Legal/Regulatory	Aviation Accidents/Incidents	Safety and security	Zero fatalities	Passengers	FACTORS 2018
H2020_2014_2020	National public authorities	Legal/Regulatory	Balloon Notices	Safety and security	Zero fatalities	Passengers	FODCOMs (GA)
H2020_2014_2020	National public authorities	Legal/Regulatory	Safety Notices	Safety and security	Zero fatalities	Passengers	SCI - SNs
H2020_2014_2020	National public authorities	Legal/Regulatory	Unmanned Aircraft	Safety and security	Design integration	Technological prospects	UAV

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used	Research trends keywords #4 used
H2020_2014_2020	European public authorities	Transport planning	Safety Notices	Emissions reduction	Increasing safety	Traffic congestion	ATC
H2020_2014_2020	European public authorities	Business modelling	Cost-effectiveness and productivity for (ANSPs) in Europe	Increased efficiency	Effective transport management system	Traffic congestion	ATC
H2020_2014_2020	National public authorities	Transport planning	Transport plan	Innovative freight delivery systems	Interoperability of transport systems		
H2020_2014_2020	National public authorities	Transport planning	Transport demand	Interoperability of transport systems	Demographic trends		
H2020_2014_2020	Other public authorities	Transport planning	Transport demand	Interoperability of transport systems	Demographic trends		
H2020_2014_2020	Other public authorities	Transport planning	Transport demand	Interoperability of transport systems	Demographic trends		
H2020_2014_2020	European public authorities	Legal/Regulatory	Legal issues	Forward-looking activities			
H2020_2014_2020	European public authorities	Legal/Regulatory	Legal issues	Innovative freight delivery systems	Blockchain		
H2020_2014_2020	Other public authorities	Legal/Regulatory	Legal issues	Innovative freight delivery systems	Safety and security		
H2020_2014_2020	Other public authorities	Transport planning	Transport network	Interoperability of transport systems	On-demand public transport		

Table 50: Scientific resources gathered for data from published research

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP5_1998_2002	WoS	Business modelling	Transportation models	Effective transport management system	Development of critical technologies	Traffic congestion
FP5_1998_2002	WoS	Environmental	Emissions reduction	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Environmental	Climate change	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Socio-economic	Cost Benefit Analysis	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Transport planning	Urban studies	Urban pollution	Environmental constrains	Safety constrains
FP5_1998_2002	WoS	Technological	Control systems	Technological prospects	Development of critical technologies	
FP5_1998_2002	WoS	Legal/Regulatory	Policy makers			
FP5_1998_2002	WoS	Socio-economic	Economic impact	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Socio-economic	Economic development	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Transport planning	Transport network	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Transport planning	Accessibility	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Transport planning	Land use	Economic development	Social constrains	Traffic congestion
FP5_1998_2002	WoS	Environmental	Noise pollution	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Socio-economic	Productivity	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Technological	Design of vehicles	Technological prospects		
FP5_1998_2002	WoS	Technological	Hybrid vehicles	Development of	Technological	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
				critical technologies	prospects	
FP5_1998_2002	WoS	Technological	Electric vehicles	Development of critical technologies	Technological prospects	
FP5_1998_2002	WoS	Technological	Propusion systems	Development of critical technologies	Technological prospects	
FP5_1998_2002	WoS	Business modelling	Business process modelling			
FP5_1998_2002	WoS	Transport planning	Urban design	Economic development	Technological prospects	
FP5_1998_2002	WoS	Technological	Transhipment systems	Technological prospects	Development of critical technologies	
FP5_1998_2002	WoS	Transport planning	Transport plan	Economic development	Technological prospects	
FP5_1998_2002	WoS	Transport planning	Transport demand	Economic development	Technological prospects	
FP5_1998_2002	WoS	Technological	Autonomous vehicles	Technological prospects	Development of critical technologies	
FP5_1998_2002	WoS	Technological	Safety systems	Increasing safety	Safety constrains	Technological prospects
FP5_1998_2002	WoS	Environmental	Congestion	Growing of mobility demand	Increased efficiency	Quality of transport system and services
FP5_1998_2002	WoS	Socio-economic	Economic growth	Economic development	Employment	System competitiveness
FP5_1998_2002	WoS	Environmental	Environmental Impact Assessment	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Environmental	Sustainable urban systems	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Environmental	Environmental performances	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Socio-economic	Social impacts	Urban pollution	Emissions reduction	Environmental constrains

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP5_1998_2002	WoS	Socio-economic	Social service	Urban pollution	Emissions reduction	Environmental constrains
FP5_1998_2002	WoS	Transport planning	Urban simulation models	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Business modelling	Shared mobility	Economic development	Social constrains	Traffic congestion
FP5_1998_2002	WoS	Business modelling	Innovative solutions	Economic development	Social constrains	Traffic congestion
FP5_1998_2002	WoS	Legal/Regulatory	Transport regulation	System competitiveness	Growing of mobility demand	Cooperation between manufacturers
FP5_1998_2002	WoS	Technological	Lightweight	Technological prospects	Increasing safety	
FP5_1998_2002	WoS	Environmental	Alternative fuels	Effective transport management system	Growing of mobility demand	Environmental constrains
FP5_1998_2002	WoS	Socio-economic	Social inclusion	Effective transport management system	Growing of mobility demand	Environmental constrains
FP5_1998_2002	WoS	Legal/Regulatory	Incentives			
FP5_1998_2002	WoS	Business modelling	Organisational structure	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Legal/Regulatory	EU Directive	System competitiveness	Growing of mobility demand	Cooperation between manufacturers
FP5_1998_2002	WoS	Legal/Regulatory	Action plan	Safety constrains	Increasing safety	Social constrains
FP5_1998_2002	WoS	Environmental	Sustainable transport	Urban pollution	Sustainable use of resources	Environmental constrains
FP5_1998_2002	WoS	Socio-economic	Sustainable development	Urban pollution	Sustainable use of resources	Environmental constrains
FP5_1998_2002	WoS	Business modelling	Integrated business models	Economic development	Social constrains	
FP5_1998_2002	WoS	Legal/Regulatory	Regulatory barriers	System competitiveness	Cooperation between manufacturers	
FP5_1998_2002	WoS	Environmental	Environmental			

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
			efficiency			
FP5_1998_2002	WoS	Transport planning	Traffic engineering	Economic development	Technological prospects	Development of critical technologies
FP5_1998_2002	WoS	Technological	ITS applications	Technological prospects	Development of critical technologies	
FP5_1998_2002	WoS	Legal/Regulatory	Regulatory framework	System competitiveness	Cooperation between manufacturers	
FP5_1998_2002	WoS	Transport planning	Integrated urban plan	Economic development	Technological prospects	
FP5_1998_2002	WoS	Technological	Design of vehicles	Evironmental friendly transport		marine transport
FP5_1998_2002	WoS	Technological	Design of vehicles			marine transport
FP5_1998_2002	WoS	Technological	Design of vehicles			marine transport
FP5_1998_2002	WoS	Technological	Control system			marine transport
FP5_1998_2002	WoS	Technological	Control system			marine transport
FP5_1998_2002	SCOPUS	Technological	Process automation			marine transport
FP5_1998_2002	SCOPUS	Technological	Safety systems			marine transport
FP6_2002_2006	WoS	Environmental	Environmental efficiency	Evironmental friendly transport	Vehicle efficiency	Clean vehicle fleets
FP6_2002_2006	WoS	Technological	Control systems	Evironmental friendly transport	Vehicle efficiency	Clean vehicle fleets
FP6_2002_2006	WoS	Technological	Safety systems	Evironmental friendly transport	Vehicle efficiency	Clean vehicle fleets
FP6_2002_2006	WoS	Socio-economic	Economic development			
FP6_2002_2006	WoS	Business modelling	Transportation models	Interoperability	Integration with other transport modes	Innovative freight logistics services
FP6_2002_2006	WoS	Environmental	Congestion	Competitive transport	Payment systems	Security
FP6_2002_2006	WoS	Socio-economic	Economic growth	Competitive transport	Payment systems	Security

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP6_2002_2006	WoS	Socio-economic	Productivity	Competitive transport	Payment systems	Security
FP6_2002_2006	WoS	Transport planning	Land use	Dedicated infrastructure	Competitive transport	
FP6_2002_2006	WoS	Transport planning	Urban design	Dedicated infrastructure	Competitive transport	
FP6_2002_2006	WoS	Socio-economic	Economic impact	Competitive transport	Mobility services for people and goods	Innovation and competitiveness
FP6_2002_2006	WoS	Transport planning	Transport plan	Competitive transport	Mobility services for people and goods	Innovation and competitiveness
FP6_2002_2006	WoS	Transport planning	Transport network	Competitive transport	Mobility services for people and goods	Innovation and competitiveness
FP6_2002_2006	WoS	Transport planning	Accessibility	Accessibility	Integration with other transport modes	
FP6_2002_2006	WoS	Transport planning	Transport demand	Accessibility	Integration with other transport modes	
FP6_2002_2006	WoS	Transport planning	Urban studies	Accessibility	Integration with other transport modes	
FP6_2002_2006	WoS	Technological	Design of vehicles	Vehicle efficiency	Rational use of motorised transport	Clean maintenance
FP6_2002_2006	WoS	Technological	Hybrid vehicles	Evironmental friendly transport	Integration with other transport modes	Innovative freight logistics services
FP6_2002_2006	WoS	Socio-economic	Social impacts			
FP6_2002_2006	WoS	Legal/Regulatory	Policy makers			
FP6_2002_2006	WoS	Legal/Regulatory	Incentives	Competitive transport	Innovative freight logistics services	
FP6_2002_2006	WoS	Environmental	Emissions reduction	Competitive transport	Clean vehicle fleets	Security
FP6_2002_2006	WoS	Environmental	Climate change	Competitive transport	Clean vehicle fleets	Security
FP6_2002_2006	WoS	Environmental	Environmental performances	Competitive transport	Clean vehicle fleets	Security
FP6_2002_2006	WoS	Legal/Regulatory	Action plan	Interoperability	Integration with other transport modes	Innovative freight logistics services

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP6_2002_2006	WoS	Technological	Electric vehicles	Vehicle efficiency	Rational use of motorised transport	Clean maintenance
FP6_2002_2006	WoS	Technological	Propusion systems	Vehicle efficiency	Rational use of motorised transport	Clean maintenance
FP6_2002_2006	WoS	Socio-economic	Cost Benefit Analysis	Clean maintenance	Security	Dedicated infrastructure
FP6_2002_2006	WoS	Technological	Lightweight	Security	Clean maintenance	
FP6_2002_2006	WoS	Environmental	Environmental Impact Assessment	Competitive transport	Clean vehicle fleets	Security
FP6_2002_2006	WoS	Environmental	Noise pollution	Evironmental friendly transport	Polluting transport	Security
FP6_2002_2006	WoS	Legal/Regulatory	Transport regulation	Evironmental friendly transport	Vehicle efficiency	Innovative freight logistics services
FP6_2002_2006	WoS	Business modelling	Organisational structure	Competitive transport	Innovative freight logistics services	Security
FP6_2002_2006	WoS	Legal/Regulatory	Legal issues	Guidance and traffic management	Security	Navigation services
FP6_2002_2006	WoS	Technological	Transhipment systems	Interoperability	Integration with other transport modes	Innovative freight logistics services
FP6_2002_2006	WoS	Socio-economic	Sustainable development	Evironmental friendly transport	Vehicle efficiency	Innovative freight logistics services
FP6_2002_2006	WoS	Business modelling	Total cost of ownership	Dedicated infrastructure	Competitive transport	
FP6_2002_2006	WoS	Environmental	Sustainable transport	Competitive transport	Accessibility	Increase capacity of infrastructure
FP6_2002_2006	WoS	Transport planning	Traffic engineering	Security	Information services	Dedicated infrastructure
FP6_2002_2006	WoS	Business modelling	Innovative solutions	Security	Dedicated infrastructure	
FP6_2002_2006	WoS	Technological	Automated transport	Dedicated infrastructure	Guidance and traffic management	Security

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP6_2002_2006	WoS	Environmental	Sustainable urban systems			
FP6_2002_2006	WoS	Socio-economic	Social service			
FP6_2002_2006	WoS	Transport planning	Integrated urban plan			
FP6_2002_2006	WoS	Transport planning	Urban simulation models			
FP6_2002_2006	WoS	Technological	ITS applications	Dedicated infrastructure	Competitive transport	Security
FP6_2002_2006	WoS	Socio-economic	Social inclusion	Competitive transport	Collective transport	Integration with other transport modes
FP6_2002_2006	WoS	Environmental	Global warming	Evironmental friendly transport	Vehicle efficiency	Clean vehicle fleets
FP6_2002_2006	WoS	Environmental	Alternative fuels	Evironmental friendly transport	Vehicle efficiency	Clean vehicle fleets
FP6_2002_2006	WoS	Business modelling	Shared mobility	Competitive transport	Security	
FP6_2002_2006	WoS	Technological	Design of vehicles			marine transport
FP6_2002_2006	WoS	Technological	ITS applications			marine transport
FP6_2002_2006	WoS	Technological	Automated transport		Evironmental friendly transport	marine transport
FP6_2002_2006	WoS	Technological	Automated transport			marine transport
FP6_2002_2006	SCOPUS	Technological	Design of vehicles			marine transport
FP6_2002_2006	SCOPUS	Technological	Control system			marine transport
FP6_2002_2006	SCOPUS	Technological	Control system			marine transport
FP6_2002_2006	SCOPUS	Technological	Safety systems			marine transport
FP6_2002_2006	SCOPUS	Technological	Control system			marine transport
FP6_2002_2006	SCOPUS	Technological	Safety systems			marine transport
FP6_2002_2006	SCOPUS	Technological	Safety systems			marine transport
FP7_2007_ 2013	WoS	Transport planning	Transport network	Navigation and control systems for optimised	Intelligent Transport Systems	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
				planning and routing		
FP7_2007_ 2013	WoS	Technological	Control systems	Eco-innovation	Navigation and control systems for optimised planning and routing	Intelligent Transport Systems
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment	Emissions abatment		
FP7_2007_ 2013	WoS	Environmental	Environmental performances			
FP7_2007_ 2013	WoS	Environmental	Sustainable transport	Emissions abatment	Alternative and cleaner fuels	Innovation and competitiveness
FP7_2007_ 2013	WoS	Environmental	Emissions reduction	Co-modality	Intermodality	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Global warming	Co-modality	Intermodality	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Climate change	Emissions abatment	Alternative and cleaner fuels	Innovation and competitiveness
FP7_2007_ 2013	WoS	Environmental	Climate change	Co-modality	Intermodality	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Emissions abatment	Alternative and cleaner fuels	Innovation and competitiveness
FP7_2007_ 2013	WoS	Technological	Electric vehicles	Emissions abatment	Alternative and cleaner fuels	Innovation and competitiveness
FP7_2007_ 2013	WoS	Environmental	Global warming	Eco-innovation	Emissions abatment	
FP7_2007_ 2013	WoS	Environmental	Congestion	Intermodality		
FP7_2007_ 2013	WoS	Transport planning	City logistics	Intermodality		
FP7_2007_ 2013	WoS	Socio-economic	Productivity	More confortable transport	Increased use of public transport	Emerging technologies
FP7_2007_ 2013	WoS	Socio-economic	Economic impact	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Socio-economic	Economic development	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Transport planning	Transport demand	Emerging technologies	Innovation and competitiveness	More efficient transport

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Environmental	Noise pollution	More confortable transport	Emissions abatment	Vulnerable road users
FP7_2007_ 2013	WoS	Environmental	Congestion	Innovation and competitiveness	Time-to-market decrease	
FP7_2007_ 2013	WoS	Transport planning	Accessibility	More efficient transport	Vulnerable road users	
FP7_2007_ 2013	WoS	Business modelling	Transportation models	Mobility services for people and goods	Navigation and control systems for optimised planning and routing	Vulnerable road users
FP7_2007_ 2013	WoS	Transport planning	Traffic engineering	Mobility services for people and goods	Navigation and control systems for optimised planning and routing	Vulnerable road users
FP7_2007_ 2013	WoS	Transport planning	Urban simulation models	Mobility services for people and goods	Navigation and control systems for optimised planning and routing	Vulnerable road users
FP7_2007_ 2013	WoS	Technological	Safety systems	Emerging technologies	Innovation and competitiveness	Advanced driver assistance systems
FP7_2007_ 2013	WoS	Legal/Regulatory	Incentives	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Technological	Design of vehicles	Emerging technologies	Innovation and competitiveness	
FP7_2007_ 2013	WoS	Environmental	Sustainable transport	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Emissions reduction	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Climate change	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Socio-economic	Sustainable development	Emerging technologies	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Congestion	Intermodality	Mobility integration	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Transport planning	Transport plan	Intermodality	Mobility integration	
FP7_2007_ 2013	WoS	Socio-economic	Social impacts	Emerging technologies	Co-modality	Innovation and competitiveness
FP7_2007_ 2013	WoS	Socio-economic	Cost Benefit Analysis	Emerging technologies	Co-modality	Innovation and competitiveness
FP7_2007_ 2013	WoS	Environmental	Sustainable transport			
FP7_2007_ 2013	WoS	Environmental	Emissions reduction	Mobility integration	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Alternative fuels	Mobility integration	Emissions abatment	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Emissions reduction	Emissions abatment	Eco-innovation	
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment	Emissions abatment	Energy consumption reduction	
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Emissions abatment	Vulnerable road users	
FP7_2007_ 2013	WoS	Environmental	Sustainable transport	Mobility services for people and goods	Navigation and control systems for optimised planning and routing	
FP7_2007_ 2013	WoS	Technological	Hybrid vehicles	Emerging technologies	Innovation and competitiveness	
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment	Emissions abatment	Eco-innovation	Energy consumption reduction
FP7_2007_ 2013	WoS	Socio-economic	Economic growth	More efficient transport	Mobility integration	Emerging technologies
FP7_2007_ 2013	WoS	Legal/Regulatory	Policy instruments	Innovation and competitiveness	Private-public partnership	More efficient transport
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Mobility services for people and goods	Innovation and competitiveness	
FP7_2007_ 2013	WoS	Environmental	Environmental performances			
FP7_2007_ 2013	WoS	Environmental	Emissions reduction	Emissions abatment	Eco-innovation	
FP7_2007_ 2013	WoS	Environmental	Emissions reduction	Emissions abatment	Eco-innovation	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Environmental	Alternative fuels	Emissions abatment	Eco-innovation	
FP7_2007_ 2013	WoS	Legal/Regulatory	Policy makers	Innovation and competitiveness	Mobility services for people and goods	
FP7_2007_ 2013	WoS	Environmental	Sustainable transport			
FP7_2007_ 2013	WoS	Environmental	Alternative fuels			
FP7_2007_ 2013	WoS	Environmental	Environmental performances			
FP7_2007_ 2013	WoS	Environmental	Congestion			
FP7_2007_ 2013	WoS	Environmental	Congestion	Intermodality	More efficient transport	
FP7_2007_ 2013	WoS	Environmental	Climate change			
FP7_2007_ 2013	WoS	Environmental	Congestion			
FP7_2007_ 2013	WoS	Environmental	Sustainable transport	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Environmental	Sustainable transport			
FP7_2007_ 2013	WoS	Environmental	Climate change	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Environmental	Environmental performances	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Legal/Regulatory	Transport regulation	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Legal/Regulatory	Roadmap	Emerging technologies	Innovation and competitiveness	More efficient transport
FP7_2007_ 2013	WoS	Environmental	Global warming	Emissions abatment		
FP7_2007_ 2013	WoS	Environmental	Climate change	Fully integrated management systems	Mobility integration	
FP7_2007_ 2013	WoS	Environmental	Congestion	Fully integrated management systems	Mobility integration	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Business modelling	Value proposition	Mobility integration	Innovation and competitiveness	Private-public partnership
FP7_2007_ 2013	WoS	Business modelling	Value creation	Mobility integration	Innovation and competitiveness	Private-public partnership
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Emissions abatment	Alternative and cleaner fuels	Energy consumption reduction
FP7_2007_ 2013	WoS	Technological	Lightweight	Emerging technologies	Emissions abatment	Innovation and competitiveness
FP7_2007_ 2013	WoS	Environmental	Alternative fuels	More efficient transport	Innovative forms of urban transport	
FP7_2007_ 2013	WoS	Environmental	Congestion	More efficient transport	Innovative forms of urban transport	
FP7_2007_ 2013	WoS	Environmental	Congestion			
FP7_2007_ 2013	WoS	Socio-economic	Social innovation	More efficient transport	Innovative forms of urban transport	
FP7_2007_ 2013	WoS	Socio-economic	Social service	Private-public partnership	Public participation	
FP7_2007_ 2013	WoS	Environmental	Carbon footprint	Emissions abatment	Eco-innovation	
FP7_2007_ 2013	WoS	Environmental	Global warming	Emissions abatment	Eco-innovation	
FP7_2007_ 2013	WoS	Environmental	Global warming	Emissions abatment		
FP7_2007_ 2013	WoS	Environmental	Climate change	Emissions abatment		
FP7_2007_ 2013	WoS	Environmental	Congestion	Emissions abatment	Energy consumption reduction	
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Mobility services for people and goods	Private-public partnership	Vulnerable road users
FP7_2007_ 2013	WoS	Business modelling	Green business	Mobility services for people and goods	Private-public partnership	Vulnerable road users
FP7_2007_ 2013	WoS	Business modelling	Integrated business models	Mobility services for people and goods	Private-public partnership	Vulnerable road users
FP7_2007_ 2013	WoS	Legal/Regulatory	Legal barriers	Mobility services for people and goods	Private-public partnership	Vulnerable road users

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Legal/Regulatory	Regulatory barriers	Mobility services for people and goods	Private-public partnership	Vulnerable road users
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emerging technologies	Intermodality	
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Intermodality	Private-public partnership	Vulnerable road users
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment			
FP7_2007_ 2013	WoS	Environmental	Climate change	Emissions abatment	Eco-innovation	More efficient transport
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment	Navigation and control systems for optimised planning and routing	Vulnerable road users	
FP7_2007_ 2013	WoS	Business modelling	Business process modelling	Navigation and control systems for optimised planning and routing	Vulnerable road users	
FP7_2007_ 2013	WoS	Environmental	Environmental efficiency	Innovation and competitiveness		
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems	Emerging technologies	Eco-innovation	
FP7_2007_ 2013	WoS	Environmental	Environmental performances	Innovation and competitiveness		
FP7_2007_ 2013	WoS	Business modelling	Shared mobility	Mobility integration	Innovation and competitiveness	
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment			
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emissions abatment	Vulnerable road users	
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems	Co-modality		
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems	Emerging technologies	Eco-innovation	
FP7_2007_ 2013	WoS	Transport planning	Integrated urban plan	Emerging technologies	Eco-innovation	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Technological	Autonomous vehicles	Emerging technologies	Intelligent Transport Systems	Private-public partnership
FP7_2007_ 2013	WoS	Technological	Transhipment systems	Emerging technologies	Intelligent Transport Systems	Private-public partnership
FP7_2007_ 2013	WoS	Environmental	Environmental performances			
FP7_2007_ 2013	WoS	Technological	Process automation	Emerging technologies	Innovation and competitiveness	
FP7_2007_ 2013	WoS	Environmental	Environmental Impact Assessment			
FP7_2007_ 2013	WoS	Business modelling	Innovative solutions	Emerging technologies	Innovation and competitiveness	
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emissions abatment	Vulnerable road users	
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emissions abatment	Vulnerable road users	
FP7_2007_ 2013	WoS	Legal/Regulatory	Action plan	More efficient transport	Fully integrated management systems	
FP7_2007_ 2013	WoS	Legal/Regulatory	Transport governance	More efficient transport	Fully integrated management systems	
FP7_2007_ 2013	WoS	Technological	Automated transport	Intelligent Transport Systems	Navigation and control systems for optimised planning and routing	Emerging technologies
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emissions abatment	Vulnerable road users	
FP7_2007_ 2013	WoS	Business modelling	Organisational structure	Modal shift	Fully integrated management systems	Innovation and competitiveness
FP7_2007_ 2013	WoS	Technological	ITS applications	Emerging technologies	More efficient transport	Navigation and control systems for optimised planning and routing
FP7_2007_ 2013	WoS	Legal/Regulatory	Regulatory framework	Innovation and competitiveness		
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems	Energy consumption reduction	More efficient transport	Mobility services for people and goods

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Environmental	Global warming			
FP7_2007_ 2013	WoS	Transport planning	Smart city planning	More efficient transport	Vulnerable road users	
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Alternative and cleaner fuels	Eco-innovation	Vulnerable road users
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems			
FP7_2007_ 2013	WoS	Legal/Regulatory	Legal issues	Modal shift	Co-modality	Mobility services for people and goods
FP7_2007_ 2013	WoS	Legal/Regulatory	Legal framework	Modal shift	Co-modality	Mobility services for people and goods
FP7_2007_ 2013	WoS	Environmental	Global warming	Innovation and competitiveness	More efficient transport	More confortable transport
FP7_2007_ 2013	WoS	Environmental	Carbon footprint	Eco-innovation		
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emissions abatment	Vulnerable road users	
FP7_2007_ 2013	WoS	Legal/Regulatory	EU Directive	Innovation and competitiveness	Mobility services for people and goods	
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems			
FP7_2007_ 2013	WoS	Environmental	Carbon footprint	Innovation and competitiveness		
FP7_2007_ 2013	WoS	Environmental	Noise pollution	Emissions abatment	Vulnerable road users	Eco-innovation
FP7_2007_ 2013	WoS	Environmental	Sustainable urban systems			
FP7_2007_ 2013	WoS	Socio-economic	Inclusive transport	Mobility integration	Innovation and competitiveness	Public participation
FP7_2007_ 2013	WoS	Business modelling	Business model for urban mobility	Emerging technologies	Innovation and competitiveness	Navigation and control systems for optimised planning and routing
FP7_2007_ 2013	WoS	Socio-economic	Cultural heritage	Private-public partnership	Public participation	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	SCOPUS	Environmental	Environment	Zero emissions		
FP7_2007_ 2013	Google Scholar	Transport planning	Transport demand			Shared mobilty
FP7_2007_ 2013	Google Scholar	Transport planning	Transport demand			Shared mobilty
FP7_2007_ 2013	Google Scholar	Business modelling	Shared mobility			Shared mobilty
FP7_2007_ 2013	Google Scholar	Socio-economic	economic development			
FP7_2007_ 2013	WoS	Technological	ITS applications			marine transport
FP7_2007_ 2013	WoS	Technological	ITS applications			marine transport
FP7_2007_ 2013	WoS	Technological	Control system			marine transport
FP7_2007_ 2013	WoS	Technological	Autonomous vehicles	Safety and security		marine transport
FP7_2007_ 2013	WoS	Technological	Autonomous vehicles	Electric vehicles		marine transport
FP7_2007_ 2013	WoS	Technological	Autonomous vehicles	Electric vehicles		marine transport
FP7_2007_ 2013	WoS	Technological	Autonomous vehicles			marine transport
FP7_2007_ 2013	WoS	Technological	Autonomous vehicles			marine transport
FP7_2007_ 2013	WoS	Technological	Propulsion system	Electric vehicles		marine transport
FP7_2007_ 2013	WoS	Technological	Propulsion system	Mitigation of climate change		marine transport
FP7_2007_ 2013	WoS	Technological	Propulsion system			marine transport
FP7_2007_ 2013	WoS	Technological	Propulsion system			marine transport
FP7_2007_ 2013	WoS	Technological		Safety and security		marine transport
FP7_2007_ 2013	WoS	Technological		Competitiveness		marine transport
FP7_2007_ 2013	WoS	Technological		Competitiveness		marine transport
FP7_2007_ 2013	WoS	Technological		Competitiveness		marine transport
FP7_2007_ 2013	WoS	Technological	Design of vehicles			maritime transport
FP7_2007_ 2013	WoS	Technological	Control system			maritime transport
FP7_2007_ 2013	WoS	Technological	Design of vehicles			maritime transport

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
FP7_2007_ 2013	WoS	Technological	ITS applications	safety		maritime transport
FP7_2007_ 2013	WoS	Technological		Safety and security		maritime transport
FP7_2007_ 2013	SCOPUS	Technological	propulsion system	Zero emissions	safety and security	maritime transport
FP7_2007_ 2013	SCOPUS	Technological	propulsion system	Competitiveness	clean fuels	maritime transport
FP7_2007_ 2013	SCOPUS	Technological	propulsion system			maritime transport
FP7_2007_ 2013	SCOPUS	Technological	propulsion system		gas emission	maritime transport
FP7_2007_ 2013	SCOPUS	Technological	Process automation			maritime transport
FP7_2007_ 2013	SCOPUS	Technological	Hybrid vehicles			maritime transport
FP7_2007_ 2013	SCOPUS	Technological	Design of vehicles			maritime transport
FP7_2007_ 2013	SCOPUS	Technological	Design of vehicles	safety		maritime transport
FP7_2007_ 2013	Other citation database of peer-reviewed literature	Environmental	Emissions reduction	emissions abatement	Eco-innovation	
FP7_2007_ 2013	Google Scholar	Technological area	Automated transport	Automated urban vehicles		
FP7_2007_ 2013	Google Scholar	Technological area	Automated transport	Automated urban vehicles		
FP7_2007_ 2013	Google Scholar	Technological area	Automated transport	Automated urban vehicles		
FP7_2007_ 2013	Google Scholar	Technological area	Automated transport	Automated urban vehicles		
H2020_2014_2020	Other citation database of peer-reviewed literature	Transport planning	Transport solutions	Safety and security	Air quality	
H2020_2014_2020	WoS	Transport planning	Transport demand	Dependence on fossil fuels	Mitigation of climate change	
H2020_2014_2020	WoS	Technological	Control systems	Dependence on fossil fuels	Mitigation of climate change	
H2020_2014_2020	WoS	Environmental	Emission reduction	Forward-looking	Dependence on fossil	Innovative powertrain

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
				activities	fuels	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Dependence on fossil fuels		
H2020_2014_2020	WoS	Environmental	Environmental efficiency	Dependence on fossil fuels	Mitigation of climate change	
H2020_2014_2020	WoS	Environmental	Environmental performances	Zero emissions	Forward-looking activities	
H2020_2014_2020	WoS	Technological	ITS applications	Forward-looking activities	Dependence on fossil fuels	Innovative powertrain
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Environmental	Environmental performances	Forward-looking activities		
H2020_2014_2020	WoS	Technological	Safety systems	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Technological	Safety systems	Common standards and procedures	Forward-looking activities	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Technological	Design of vehicles	New materials and processes	Innovative powertrains	
H2020_2014_2020	WoS	Technological	Safety systems	New materials and processes	Innovative powertrains	
H2020_2014_2020	WoS	Technological	Lightweight	New materials and processes	Safety and security	
H2020_2014_2020	WoS	Environmental	Emission reduction	Dependence on fossil fuels	Innovative powertrains	
H2020_2014_2020	WoS	Technological	Safety systems	Common standards and procedures	New materials and processes	
H2020_2014_2020	WoS	Business modelling	Innovative solutions	Competitiveness		

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Technological	Safety systems	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative powertrains	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Transport planning	Urban studies	Common standards and procedures	New materials and processes	
H2020_2014_2020	WoS	Transport planning	Urban design	Common standards and procedures	New materials and processes	
H2020_2014_2020	WoS	Technological	Control systems			
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative powertrains	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Environmental efficiency	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Economic impact	Competitiveness		
H2020_2014_2020	WoS	Socio-economic	Economic growth	Forward-looking activities		
H2020_2014_2020	WoS	Business modelling	Transportation models	Forward-looking activities		
H2020_2014_2020	WoS	Transport planning	Transport demand	Forward-looking activities		
H2020_2014_2020	WoS	Technological	Hybrid vehicles	Forward-looking activities		
H2020_2014_2020	WoS	Technological	Electric vehicles	Forward-looking activities		
H2020_2014_2020	WoS	Environmental	Environmental performances	Adverse health effects	Safety and security	
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Adverse health effects	Safety and security	
H2020_2014_2020	WoS	Transport planning	Urban design	Adverse health effects	Safety and security	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Technological	Design of vehicles	Adverse health effects	Safety and security	
H2020_2014_2020	WoS	Environmental	Environmental performances	Zero emissions		
H2020_2014_2020	WoS	Technological	Control systems			
H2020_2014_2020	WoS	Socio-economic	Economic impact	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Transport planning	Accessibility	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Transport planning	Land use	Adverse health effects	Air quality	
H2020_2014_2020	WoS	Transport planning	Transport network			
H2020_2014_2020	WoS	Transport planning	Land use			
H2020_2014_2020	WoS	Transport planning	Accessibility			
H2020_2014_2020	WoS	Business modelling	Transportation models	Demographic trends		
H2020_2014_2020	WoS	Socio-economic	Social impacts	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Socio-economic	Economic impact	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Business modelling	Transportation models	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Transport planning	Transport plan	Competitiveness		
H2020_2014_2020	WoS	Transport planning	Transport network			
H2020_2014_2020	WoS	Transport planning	Transport network			
H2020_2014_2020	WoS	Transport planning	Accessibility	Competitiveness		
H2020_2014_2020	WoS	Transport planning	Transport demand			
H2020_2014_2020	WoS	Technological	Control systems	New materials and processes	Innovative powertrains	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Technological	Hybrid vehicles	New materials and processes	Innovative powertrains	
H2020_2014_2020	WoS	Technological	Propusion systems	New materials and processes	Innovative powertrains	
H2020_2014_2020	WoS	Technological	Design of vehicles	New materials and processes	Innovative powertrains	
H2020_2014_2020	WoS	Technological	Design of vehicles	New materials and processes	Safety and security	
H2020_2014_2020	WoS	Business modelling	Transportation models	Innovative freight delivery systems	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Transport planning	Transport plan	Innovative freight delivery systems		
H2020_2014_2020	WoS	Transport planning	Accessibility	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Technological	Control systems	Common standards and procedures	Air quality	Safety and security
H2020_2014_2020	WoS	Technological	Safety systems	Common standards and procedures	New materials and processes	
H2020_2014_2020	WoS	Socio-economic	Economic impact	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Socio-economic	Economic development	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Socio-economic	Sustainable development	Interoperability of transport systems	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Transport planning	Transport plan	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Transport network	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Accessibility	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative powertrains	Dependence on fossil fuels	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Alternative fuels			
H2020_2014_2020	WoS	Environmental	Sustainable urban systems	Interoperability of transport systems	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Business modelling	Transportation models	Competitiveness	New materials and processes	
H2020_2014_2020	WoS	Technological	Control systems	Interoperability of transport systems	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Technological	Control systems	Competitiveness	New materials and processes	
H2020_2014_2020	WoS	Technological	Design of vehicles	New materials and processes	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Transport network			
H2020_2014_2020	WoS	Transport planning	Transport demand			
H2020_2014_2020	WoS	Technological	Process automation	Automated Road Transport	Robust transport systems	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Business modelling	Transportation models	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Transport planning	Transport network			
H2020_2014_2020	WoS	Technological	Safety systems	Common standards and procedures	Personalised/smart services	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects	Common standards and procedures	
H2020_2014_2020	WoS	Socio-economic	Economic impact	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Innovative powertrains	Dependence on fossil fuels	
H2020_2014_2020	WoS	Socio-economic	Economic	Competitiveness	Forward-looking	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
			development		activities	
H2020_2014_2020	WoS	Transport planning	Urban studies	Adverse health effects	Air quality	
H2020_2014_2020	WoS	Transport planning	Urban design	Common standards and procedures		
H2020_2014_2020	WoS	Transport planning	Accessibility	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Legal/Regulatory	Regulatory framework	Competitiveness	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Urban design	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Environmental	Emission reduction		Air quality	
H2020_2014_2020	WoS	Transport planning	Transport demand			
H2020_2014_2020	WoS	Environmental	Emission reduction			
H2020_2014_2020	WoS	Socio-economic	Sustainable development	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Business modelling	Transportation models	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Transport planning	Urban studies	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Transport planning	Land use	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Transport planning	Accessibility	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Common standards and procedures	Adverse health effects	
H2020_2014_2020	WoS	Transport planning	Urban studies			
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Common standards and procedures	Adverse health effects	
H2020_2014_2020	WoS	Transport planning	Urban design	Common standards and procedures	Adverse health effects	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Technological	Safety systems			
H2020_2014_2020	WoS	Business modelling	Business process modelling	Safety and security	Competitiveness	
H2020_2014_2020	WoS	Business modelling	Transportation models	Multi-disciplinary collaborations	New materials and processes	
H2020_2014_2020	WoS	Transport planning	Transport network			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Common standards and procedures	Adverse health effects	
H2020_2014_2020	WoS	Transport planning	Urban studies	Competitiveness		
H2020_2014_2020	WoS	Environmental	Congestion	Seamless mobility	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Transport plan	Seamless mobility	Competitiveness	
H2020_2014_2020	WoS	Transport planning	Integrated urban plan	Seamless mobility	Competitiveness	
H2020_2014_2020	WoS	Transport planning	Urban studies	Seamless mobility	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Land use	Seamless mobility	Forward-looking activities	
H2020_2014_2020	WoS	Transport planning	Transport demand			
H2020_2014_2020	WoS	Environmental	Emission reduction	Forward-looking activities		
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Socio-economic	Economic impact	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Economic growth	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Productivity	Forward-looking activities		

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Socio-economic	Economic development	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Sustainable development	Forward-looking activities		
H2020_2014_2020	WoS	Transport planning	Urban studies	Common standards and procedures		
H2020_2014_2020	WoS	Transport planning	Urban studies			
H2020_2014_2020	WoS	Transport planning	Land use	Forward-looking activities		
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Forward-looking activities		
H2020_2014_2020	WoS	Transport planning	Transport demand	Forward-looking activities		
H2020_2014_2020	WoS	Transport planning	Transport demand	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Common standards and procedures	Adverse health effects	
H2020_2014_2020	WoS	Transport planning	Transport plan	Zero emissions	Dependence on fossil fuels	
H2020_2014_2020	WoS	Transport planning	Transport plan	Competitiveness	Demographic trends	
H2020_2014_2020	WoS	Transport planning	Transport plan	New materials and processes	Competitiveness	
H2020_2014_2020	WoS	Transport planning	Transport network	New materials and processes	Competitiveness	
H2020_2014_2020	WoS	Transport planning	City logistics	Competitiveness	Demographic trends	
H2020_2014_2020	WoS	Transport planning	Accessibility			
H2020_2014_2020	WoS	Transport planning	Transport demand	Competitiveness	Demographic trends	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Common standards and procedures	Adverse health effects	
H2020_2014_2020	WoS	Environmental	Climate change	Seamless mobility	Mitigation of climate change	Demographic trends

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Alternative fuels			
H2020_2014_2020	WoS	Transport planning	Accessibility	Forward-looking activities	Demographic trends	
H2020_2014_2020	WoS	Technological	Hybrid vehicles			
H2020_2014_2020	WoS	Technological	Electric vehicles			
H2020_2014_2020	WoS	Socio-economic	Cultural heritage	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Sustainable development			
H2020_2014_2020	WoS	Transport planning	Accessibility			
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Competitiveness		
H2020_2014_2020	WoS	Technological	Hybrid vehicles	Innovative powertrains		
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Climate change	Demographic trends		
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Transport planning	Urban design	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Climate change	Forward-looking activities	Resilient transport systems	Safety and security
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Socio-economic	Economic development	Forward-looking activities	Resilient transport systems	Safety and security
H2020_2014_2020	WoS	Socio-economic	Social service			
H2020_2014_2020	WoS	Business modelling	Business model for			

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
			urban mobility			
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Transport planning	Urban simulation models			
H2020_2014_2020	WoS	Transport planning	Urban design	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Transport planning	Urban design			
H2020_2014_2020	WoS	Transport planning	Urban design	Innovative powertrains	New materials and processes	
H2020_2014_2020	WoS	Legal/Regulatory	Incentives			
H2020_2014_2020	WoS	Environmental	Alternative fuels	Dependence on fossil fuels		
H2020_2014_2020	WoS	Environmental	Congestion	Automated Road Transport	Seamless mobility	Competitiveness
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Business modelling	Green business	Dependence on fossil fuels	Competitiveness	
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Automated Road Transport	Safety and security	
H2020_2014_2020	WoS	Technological	Hybrid vehicles	Innovative powertrains		
H2020_2014_2020	WoS	Legal/Regulatory	Transport regulation	Forward-looking activities	Dependence on fossil fuels	Multi-disciplinary collaborations
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Forward-looking activities		
H2020_2014_2020	WoS	Business modelling	Business process modelling	Competitiveness		
H2020_2014_2020	WoS	Transport planning	Transport plan	Forward-looking activities	Competitiveness	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Common standards and procedures	Safety and security	
H2020_2014_2020	WoS	Technological	Electric vehicles	Forward-looking activities	Competitiveness	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	New materials and processes		
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Socio-economic	Productivity	Common standards and procedures	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Socio-economic	Economic development			
H2020_2014_2020	WoS	Socio-economic	Economic development			
H2020_2014_2020	WoS	Technological	Hybrid vehicles	Innovative powertrains	New materials and processes	
H2020_2014_2020	WoS	Technological	Propusion systems	Innovative powertrains	New materials and processes	
H2020_2014_2020	WoS	Legal/Regulatory	Policy instruments	Common standards and procedures	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers	Common standards and procedures	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Economic development	Adverse health effects		
H2020_2014_2020	WoS	Socio-economic	Economic development	Forward-looking activities		
H2020_2014_2020	WoS	Transport planning	Integrated urban plan	Dependence on fossil fuels		
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Common standards and procedures	Safety and security	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Transport planning	Urban design			
H2020_2014_2020	WoS	Environmental	Emission reduction			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Carbon footprint	Dependence on fossil fuels	Air quality	
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Environmental efficiency	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Productivity	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Social service	Demographic trends		
H2020_2014_2020	WoS	Transport planning	Integrated urban plan	Robust transport systems	Competitiveness	
H2020_2014_2020	WoS	Transport planning	Urban simulation models	Common standards and procedures	Competitiveness	
H2020_2014_2020	WoS	Transport planning	Urban simulation models	New materials and processes	Common standards and procedures	
H2020_2014_2020	WoS	Technological	ITS applications	Innovative powertrains		
H2020_2014_2020	WoS	Technological	ITS applications	New materials and processes		
H2020_2014_2020	WoS	Legal/Regulatory	Incentives	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Legal/Regulatory	Incentives			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Climate change	Forward-looking activities		

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Congestion	Personalised/smart services		
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Socio-economic	Cost Benefit Analysis	Forward-looking activities	Competitiveness	
H2020_2014_2020	WoS	Socio-economic	Economic growth	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Productivity	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Productivity	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Technological	ITS applications	New materials and processes		
H2020_2014_2020	WoS	Technological	ITS applications	Common standards and procedures		
H2020_2014_2020	WoS	Legal/Regulatory	Action plan	Common standards and procedures		
H2020_2014_2020	WoS	Socio-economic	Sustainable development	Competitiveness		
H2020_2014_2020	WoS	Business modelling	Green business	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Business modelling	Value creation	Competitiveness		
H2020_2014_2020	WoS	Technological	Electric vehicles	New materials and processes		
H2020_2014_2020	WoS	Technological	Propusion systems	New materials and processes		
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers	Competitiveness		
H2020_2014_2020	WoS	Legal/Regulatory	Transport governance			

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Climate change			
H2020_2014_2020	WoS	Environmental	Emission reduction			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Environmental	Sustainable urban systems			
H2020_2014_2020	WoS	Socio-economic	Economic growth	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Economic growth	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Productivity			
H2020_2014_2020	WoS	Socio-economic	Social service	Demographic trends	Adverse health effects	
H2020_2014_2020	WoS	Business modelling	Business process modelling	Competitiveness		
H2020_2014_2020	WoS	Business modelling	Innovative solutions	Competitiveness		
H2020_2014_2020	WoS	Transport planning	Traffic engineering	Common standards and procedures	New materials and processes	
H2020_2014_2020	WoS	Technological	Electric vehicles	New materials and processes		
H2020_2014_2020	WoS	Technological	Electric vehicles			
H2020_2014_2020	WoS	Legal/Regulatory	Transport regulation	Dependence on fossil fuels	Competitiveness	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Demographic trends	Adverse health effects	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Climate change	Forward-looking activities	Resilient transport systems	Safety and security
H2020_2014_2020	WoS	Environmental	Congestion	Seamless mobility	Interoperability of transport systems	
H2020_2014_2020	WoS	Socio-economic	Social impacts	Demographic trends	Adverse health effects	
H2020_2014_2020	WoS	Socio-economic	Economic growth	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Sustainable development	Interoperability of transport systems		
H2020_2014_2020	WoS	Technological	Hybrid vehicles	Innovative powertrains	New materials and processes	
H2020_2014_2020	WoS	Technological	Electric vehicles	Innovative powertrains	New materials and processes	
H2020_2014_2020	WoS	Environmental	Emission reduction	Dependence on fossil fuels	Forward-looking activities	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Dependence on fossil fuels	Forward-looking activities	
H2020_2014_2020	WoS	Socio-economic	Social impacts	Demographic trends	Adverse health effects	
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers	Multi-disciplinary collaborations	Competitiveness	
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers	Seamless mobility	Competitiveness	
H2020_2014_2020	WoS	Legal/Regulatory	Incentives	Multi-disciplinary collaborations	Competitiveness	
H2020_2014_2020	WoS	Environmental	Emission reduction	Seamless mobility	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Emission reduction			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Common standards and procedures	Adverse health effects	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Congestion	Inclusive and	Personalised/smart	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
				affordable transport	services	
H2020_2014_2020	WoS	Environmental	Congestion	Inclusive and affordable transport	Demographic trends	
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Socio-economic	Social impacts	Competitiveness		
H2020_2014_2020	WoS	Socio-economic	Economic growth	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Productivity	Competitiveness		
H2020_2014_2020	WoS	Socio-economic	Productivity	Multi-disciplinary collaborations		
H2020_2014_2020	WoS	Socio-economic	Social service	Competitiveness		
H2020_2014_2020	WoS	Business modelling	Innovative solutions	Competitiveness		
H2020_2014_2020	WoS	Technological	Propusion systems			
H2020_2014_2020	WoS	Environmental	Emission reduction	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Environmental	Emission reduction	Dependence on fossil fuels	Competitiveness	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects	Common standards and procedures	
H2020_2014_2020	WoS	Environmental	Climate change	Resilient transport systems	Safety and security	Forward-looking activities
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects	new materials and processes	
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Sustainable urban systems	Seamless mobility	Forward-looking activities	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Socio-economic	Productivity			
H2020_2014_2020	WoS	Business modelling	Green business	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Transport planning	Integrated urban plan	Seamless mobility	Competitiveness	
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers	Demographic trends		
H2020_2014_2020	WoS	Legal/Regulatory	Policy makers			
H2020_2014_2020	WoS	Legal/Regulatory	Action plan	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Legal/Regulatory	Action plan			
H2020_2014_2020	WoS	Legal/Regulatory	Incentives	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Legal/Regulatory	Legal issues	Competitiveness	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Emission reduction	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative powertrains	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative powertrains	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Common standards and procedures	New materials and processes	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Forward-looking activities	Dependence on fossil fuels	Competitiveness
H2020_2014_2020	WoS	Environmental	Global warming	Forward-looking activities		
H2020_2014_2020	WoS	Environmental	Global warming			
H2020_2014_2020	WoS	Environmental	Climate change	Forward-looking activities	Dependence on fossil fuels	Competitiveness

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Congestion	Seamless mobility	Competitiveness	Air quality
H2020_2014_2020	WoS	Environmental	Congestion	Air quality	Zero emissions	Forward-looking activities
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects	New materials and processes	
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Environmental efficiency	Innovative powertrains	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Environmental efficiency	Forward-looking activities	Dependence on fossil fuels	Competitiveness
H2020_2014_2020	WoS	Environmental	Sustainable urban systems	Forward-looking activities		
H2020_2014_2020	WoS	Socio-economic	Social service			
H2020_2014_2020	WoS	Business modelling	Integrated business models	Competitiveness		
H2020_2014_2020	WoS	Transport planning	Integrated urban plan	Forward-looking activities	competitiveness	
H2020_2014_2020	WoS	Transport planning	Integrated urban plan	Robust transport systems	Seamless mobility	
H2020_2014_2020	WoS	Legal/Regulatory	Policy instruments	Competitiveness	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Legal/Regulatory	EU Directive	Competitiveness	Multi-disciplinary collaborations	
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative freight delivery systems	Common standards and procedures	
H2020_2014_2020	WoS	Environmental	Carbon footprint	Forward-looking activities		
H2020_2014_2020	WoS	Environmental	Climate change	Safety and security		
H2020_2014_2020	WoS	Environmental	Congestion			
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Environmental	Environmental efficiency			
H2020_2014_2020	WoS	Transport planning	Traffic engineering	Common standards and procedures		
H2020_2014_2020	WoS	Transport planning	Traffic engineering	Common standards and procedures		
H2020_2014_2020	WoS	Technological	Automated transport	Interoperability of transport systems	Common standards and procedures	
H2020_2014_2020	WoS	Technological	Propusion systems	Innovative powertrains	New materials and processes	
H2020_2014_2020	WoS	Legal/Regulatory	Transport regulation			
H2020_2014_2020	WoS	Environmental	Emission reduction	Innovative freight delivery systems	Dependence on fossil fuels	
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment			
H2020_2014_2020	WoS	Environmental	Environmental Impact Assessment	Forward-looking activities		
H2020_2014_2020	WoS	Environmental	Climate change	Safety and security	Forward-looking activities	
H2020_2014_2020	WoS	Environmental	Climate change	Forward-looking activities		
H2020_2014_2020	WoS	Environmental	Noise pollution	Adverse health effects		
H2020_2014_2020	WoS	Environmental	Sustainable urban systems			
H2020_2014_2020	WoS	Environmental	Sustainable urban systems			
H2020_2014_2020	WoS	Socio-economic	Circular economy	Demographic trends		
H2020_2014_2020	WoS	Socio-economic	Social service	Demographic trends	Multi-disciplinary collaborations	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
H2020_2014_2020	WoS	Socio-economic	Social service			
H2020_2014_2020	WoS	Business modelling	Organisational structure	Safety and security	Adverse health effects	
H2020_2014_2020	WoS	Business modelling	Green business			
H2020_2014_2020	WoS	Business modelling	Value creation			
H2020_2014_2020	WoS	Business modelling	Integrated business models			
H2020_2014_2020	WoS	Transport planning	City logistics	Common standards and procedures		
H2020_2014_2020	WoS	Technological	Automated transport			
H2020_2014_2020	WoS	Legal/Regulatory	Action plan	Competitiveness	New materials and processes	Safety and security
H2020_2014_2020	WoS	Legal/Regulatory	Action plan	Competitiveness	New materials and processes	Safety and security
H2020_2014_2020	WoS	Socio-economic	Social inclusion			
H2020_2014_2020	WoS	Socio-economic	Circular economy			
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport			
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport			
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport	Multi-disciplinary collaborations		
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport	Multi-disciplinary collaborations		
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport	Multi-disciplinary collaborations	Electric vehicles	Inclusive and affordable transport
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport			
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport			
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport	Interoperability of transport systems		
H2020_2014_2020	Google Scholar	Environmental	Sustainable transport	New materials and	Resilient transport	

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
				processes	systems	
H2020_2014_2020	Other citation database of peer-reviewed literature	Environmental	Sustainable transport	Innovative freight delivery systems	Shared mobility for people and goods	
H2020_2014_2020	Other citation database of peer-reviewed literature	Business modelling	aircraft and employee productivity	Competitiveness	New materials and processes	operational performance
H2020_2014_2020	Other citation database of peer-reviewed literature		Open Sky	Competitiveness	Competitiveness	Open Skies
H2020_2014_2020	WoS	Technological	ITS applications	Safety and security	Inclusive and affordable transport	marine
H2020_2014_2020	WoS	Technological	Control system	Interoperability of transport systems	Robust transport systems	marine
H2020_2014_2020	WoS	Technological	Automated transport	Inclusive and affordable transport	Safety and security	marine
H2020_2014_2020	WoS	Technological	Propulsion system	Dependence on fossil fuels	Zero emissions	marine
H2020_2014_2020	WoS	Technological	Autonomous vehicles	Resilient transport systems	Safety and security	marine
H2020_2014_2020	WoS	Technological	Safety systems	Resilient transport systems	Safety and security	marine transport
H2020_2014_2020	WoS	Technological	Common standards and procedures	Resilient transport systems	Innovative freight delivery systems	marine transport
H2020_2014_2020	WoS	Technological	Resilient transport systems	Resilient transport systems	Innovative freight delivery systems	marine transport
H2020_2014_2020	WoS	Technological	Interoperability of transport systems	Competitiveness		marine transport
H2020_2014_2020	WoS	Technological		Competitiveness		marine transport
H2020_2014_2020	WoS	Technological		Competitiveness		marine transport
H2020_2014_2020	WoS	Technological	Air quality	Dependence on fossil	Zero emissions	marine transport

Period of reference (depending on FP)	Type of source investigated	Competence area	Competence area keyword/s used	Research trends keywords #1 used	Research trends keywords #2 used	Research trends keywords #3 used
				fuels		
H2020_2014_2020	WoS	Technological	Safety systems	Safety and security		marine transport
H2020_2014_2020	WoS	Technological	Process automation			marine transport
H2020_2014_2020	WoS	Technological	Process automation			marine transport
H2020_2014_2020	WoS	Technological	Process automation			marine transport
H2020_2014_2020	WoS	Technological	Design of vehicles			marine transport
H2020_2014_2020	WoS	Technological	Design of vehicles			marine transport
H2020_2014_2020	WoS	Technological	Hybrid vehicles			marine transport
H2020_2014_2020	WoS	Technological	Electric vehicles			marine transport
H2020_2014_2020	WoS	Technological	ITS applications			marine transport
H2020_2014_2020	WoS	Technological	ITS applications			marine transport
H2020_2014_2020	SCOPUS	Technological	Design of vehicles			marine transport
H2020_2014_2020	SCOPUS	Technological	Electric vehicles			marine transport
H2020_2014_2020	WoS	Technological	Propulsion system			marine transport
H2020_2014_2020	WoS	Technological	Propulsion system			marine transport
H2020_2014_2020	WoS	Technological	Propulsion system			marine transport
H2020_2014_2020	WoS	Technological	Propulsion system	Zero emissions		marine transport
H2020_2014_2020	WoS	Technological	Propulsion system			marine transport
H2020_2014_2020	WoS	Technological	Propulsion system			marine transport
H2020_2014_2020	SCOPUS	Technological	Propulsion system	Electric vehicles		marine transport
H2020_2014_2020	SCOPUS	Technological	Propulsion system	Zero emissions		marine transport
H2020_2014_2020	SCOPUS	Technological	Propulsion system			marine transport
H2020_2014_2020	Google Scholar	Technological	Advanced Driver Assistance Systems	Automated Road Transport	Personalised/smart services	
H2020_2014_2020	Other citation database of peer-reviewed literature	Technological	Advanced Driver Assistance Systems	Automated Road Transport	Safety and security	