FINAL REPORT

DETRA

DEVELOPING THE EUROPEAN TRANSPORT RESEARCH ALLIANCE

SEVENTH FRAMEWORK PROGRAMME






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1 EXECUTIVE SUMMARY

Developing the European Transport Research Alliance (DETRA) was a strategic project between key transport research organisations to make an analysis of the state of the European Research Area (ERA) development within the transport domain. The DETRA partners had previously committed themselves to work together on the deepening of the ERA objectives in transport, in order to address the Grand Challenges. From this commitment, the objective grew to create the European Transport Research Alliance (ETRA) that would strengthen the transport domain. The key priorities of this Alliance would be to examine the strengths, weaknesses, opportunities and threats (SWOT) in the domain and develop a common understanding and approach to reduce fragmentation and overcome barriers.

The results of the DETRA project have been based on consultations and inputs from main stakeholders and experts to provide a series of key deliverables setting out the current situation, the identified barriers and recommendations for the next generation of the Transport ERA (ERA-T).

It was recognised that each of the following ERA themes needed to be examined in detail:

1. Mobility for researchers
2. World-class research infrastructures (RIs)
3. Stengthening research institutions
4. Sharing knowledge
5. Optimising research programmes and identifying priorities
6. International Cooperation

The DETRA project featured the following key partners:

- Forum of European National Highway Research Laboratories (FEHRL)
- European Conference of Transport Research Institutes (ECTRI)
- European Rail Research Network of Excellence (EURNEX)
- FERSI represented by Centre for Research and Technology Hellas (CERTH)
- Humanist VCE
- ISN
- Nearctis

This final report has been prepared to conclude the DETRA project and give an overview of the findings and next steps to form the ETRA to follow on from the project as of September 2012.

2 INTRODUCTION AND BACKGROUND TO DETRA

Developing the European Transport Research Alliance (DETRA) was a strategic project between key transport research organisations to make an analysis of the state of the European Research Area (ERA) development within the transport domain. The concept of DETRA derives from the Lyon Declaration. In 2008, the Lyon Declaration signatories, ECTRI, FERSI, FEHRL, EURNEX, HUMANIST, ISN and NEARCTIS committed themselves to work together on the deepening of the European Research Area (ERA) objectives in transport, in order to address the Grand Challenges. From this commitment, the objective grew to create the European Transport Research Alliance (ETRA) that would strengthen the transport domain. The key priorities of this Alliance would be to examine the strengths, weaknesses, opportunities and threats (SWOT) in the domain and develop a common understanding and approach to reduce fragmentation and overcome barriers.

This final report has been prepared to conclude the DETRA project and gives an overview of the findings and next steps to form the ETRA to follow on from the project as of September 2012.

2.1 ADDRESSING THE GRAND CHALLENGES FOR THE ERA-T

From the perspective of the DETRA partner organisations, our shared transport system is part of the problem and at the same time part of the solution for all pressing societal and political Grand Challenges addressed by the European Union (EU). These Challenges include climate change, energy, water and food, public health, ageing societies and globalisation. Some examples of these issues include the need to:

- Reduce the climate, air quality and noise impacts of transport
- Make transport infrastructure and transport systems more resilient to a changing climate
- Reduce energy consumption in the transport system and increase the security of supply
- Reduce transport system impacts on ground water supplies
- Consider transport in land-use planning
- Increase the effectiveness of transport necessary for food production (including in developing countries) and improve transport logistics to reduce food waste
- Raise the standards of public health by increasing access to health facilities (including developing countries), increasing the resilience of the transport system in pandemics and improving safety and security, reducing traffic accident fatalities and injuries
- Adapt transport and mobility systems for an ageing population
- Shape and maintain a transport system that reflects the needs of developing globalisation and help European transport system stakeholders to adapt accordingly

Addressing these Grand Challenges will be one of the key priorities of the ERA-T. The core belief of DETRA (and the future ETRA) is that only through a well-functioning ERA will these challenges be met. Focussing on individual elements of the ERA separately will not be sufficient because it is only through a joined-up approach that we will successfully address those challenges (see Figure 1 on next page). This requires an extension to the coordination and cooperation between transport research stakeholders. With reference to the Grand Challenges above, the greatest impacts will come from surface transport, which was the focus of the project. However, the complementary role of aviation has also been considered.

2.2 BUILDING THE ERA-T

To build the ERA-T and associated transport research programmes, the "Ljubljana process" is recognised as critical by the DETRA partners. This ERA concept combines a European "internal market" for research, where researchers, technology and knowledge freely circulate with the effective pan-European coordination of

Figure 1: The elements of the ERA-T versus the Grand Challenges

national and regional research activities, programmes and policies together with initiatives implemented and funded at European level. In the spirit of this objective, the Lyon Declaration Signatories (and DETRA partners) have been working along the following ERA themes:

a) Creating the adequate flow of competent researchers with high levels of mobility between institutions, disciplines and sectors. Some substantive progress has been achieved through various initiatives and DETRA aimed to determine how this can be enhanced. One important focus was on recommendations for a European PhD in Transport and strengthening the activities associated with the People programme in, and for the benefit of, the transport domain.

b) Establishing world-class RIs that are integrated, networked and accessible to research teams from across Europe and the world. This aspect includes not only individual 'hard' RIs such as civil engineering laboratories facilities, as well as the networks of electronic communication infrastructures that will link geographically-dispersed facilities with each other and with researchers, but also the soft infrastructures based on databases and libraries. The DETRA partners have considered not only the technical requirements for facilities that will be required to address the still-emerging issues related to, for example, climate change adaptation, but also the issues of improving the coordination of RI management and means of access to reduce fragmentation.

c) Developing excellent research institutions and communities that include engagement with effective public-private cooperation and partnerships.

d) Developing effective knowledge-sharing between policy makers, public and private research, industry and society through their links with industry and notably through their roles in many European Technology Platforms (ETPs).

e) Promoting international cooperation is a core concept for the DETRA partners. The opening of the ERA to the world is a key aspect for raising the level of scientific expertise, addressing global challenges and creating a more dynamic and competitive sector.

A number of DETRA partner organisations already include international partners within their memberships. Through these established links, the synergy between international cooperation and other ERA elements mentioned above is clear.

f) Finally, a significant emphasis has been placed on well-coordinated research programmes and priorities, including jointly-programmed public research at European level involving common priorities, coordinated implementation and joint evaluation.

Building on their roles in the relevant ETPs and links with ERA-NET Transport and ERA-NET ROAD, DETRA partners have promoted the strengthening of research governance towards the joining of forces between the existing Transport ETPs, which when achieved would be a concrete realisation of many of the main elements of an ERA-T.

3 OVERVIEW OF DETRA

The DETRA project has provided a detailed examination of the current status and structure of transport research, bringing together the competences of all the partners together with their networks and associated links to provide the most comprehensive assessment of all the aforementioned aspects of ERA development. The project has also set out and begun implementation of the next steps in developing the ETRA.

The results of the DETRA project have been based on consultations and inputs from main stakeholders and experts to provide a series of key deliverables setting out the current situation, the identified barriers and recommendations for the next generation of the ERA-T. It was recognised that each of the ERA themes needed to be examined in detail, but, reflecting the need for greater integration between each element, the main project outputs have focused on more cross-cutting aspects. For this reason, a working structure was organised that reflected each ERA theme. These were then integrated transversally into the major DETRA outputs covering the main strategic issues to be addressed in shaping a coherent ERA-T programme to 2020 (see Table 1 on next page).

3.1 THE ERA FEATURES IN DETRA

Mobility for researchers

The main scope of this *"Mobility for researchers"* task was to build up a new generation of transport researchers in the EU and its Associated States, increase their skills, improve their employability and favour their trans-national mobility in a multicultural and multidisciplinary context. Work done included the analyses of actions conducted in Europe regarding training and mobility in the transport domain in order to make some recommendations to get them improved and help in the shaping of the future EC programmes in this domain. It also included some initiatives to converge towards a joint action plan, and some methods and tools to improve training and mobility in the transport domain (design of a European PhD in transport, organisation of an "ad hoc" training programme, and setting up of a dedicated mobility web portal in transport).

This new set of initiatives is a further step towards the implementation of EC recommendations on mobility of researchers and the fifth freedom, and they pave the way to propose complementary actions that could be included in the future EC programmes and actions related to mobility.

Table 1:
Matrix of project tasks and outputs
(Lead highlighted)

		Mobility for Researchers	Research Infrastructures	Strengthening institutions	Sharing knowledge	Optimising programmes	International cooperation
Outputs	Cooperation agenda		•	•	•	•	•
	People and ideas agenda	•	•	•	•		•
	Research infrastructures agenda	•	•	•	•		•
	Overall transport programme recommendations	•	•	•	•	•	•

World-class transport RIs

"World-class transport Ris" built on previous work undertaken in the TREE[1] (Transport Research Equipments in Europe), TRANSFORUM[2] (Scientific forum on transport forecast validation and policy assessment) and other projects. Topics analysed include European RIs, international RIs, future demands and missing gaps and opportunities. The opportunities that exist to develop the RIs needed for strengthening the ERA of today and the challenges and opportunities faced by transport for the future were investigated.

Strengthening research institutions

"Strengthening research institutions" focused on how research organisations have already adapted to the ERA objectives and the actions still to be taken to become mid-21st century excellent research organisations (scientific excellence, relevance excellence, governance excellence) providing high quality services for the Knowledge Triangle (research, education, innovation).

Sharing knowledge

"Sharing knowledge" examined how knowledge is currently shared between public research organisations and industry in the transport sector and with the general public and civil society organisations. This included the processes for sharing and the institutional bottlenecks. The role of standardisation as both a barrier and enabler was considered in the different modes and sectors of the transport community. Recommendations for sharing knowledge in the future have been produced.

Optimising research programmes and identifying priorities

The objective of *"Optimising research programmes and identifying priorities"* was to study and benchmark all transport-related research programme roadmaps on national, European and international levels and, in conjunction with all key stakeholder representatives, result in a joint research programme for pan-European adoption and its key priorities. The optimisation of research programmes and identification of priorities recommends type of instruments fitting with the various stakes of the knowledge triangle.

International cooperation

"International cooperation" examined the overall status of the ERA for international transport research with ref-

[1] ***The TREE*** *project was financed by the EC as part of the Sustainable Growth programme and was carried out from 2002 to 2004. The main target was to create meaningful and cost-intensive research installations and equipment in Europe and improve the exchange of information and developments about this topic through a network. The TREE project was carried out in close co-operation with the INTRANSNET project (Network for research installations on various transport modalities).*

[2] ***TRANSFORUM*** *was a project under FP6 coordinated by Netherlands. The sub-theme under FP6 was POLICIES-3.2 The development of tools, indicators and operational parameters for assessing sustainable transport and energy systems performance*

erence to previous Framework Programme projects like "Contributions to a European Rail Research Area (CETRRA)" and "Stimulating Research with International Cooperation Partner Countries and EU Neighbouring Regions" (SIMBA and SIMBA II). The main tasks included:

- Evaluating the scope, status and success so far of international transport research cooperation
- Defining the barriers and constraints, best practice and perspectives in the context of the future ERA
- Recommending improvements to ERA supporting world-class research within international transport research cooperation and prioritisation of mutually-agreed research topics

4 MAIN DETRA OUTPUTS

The results of the DETRA project, as shown below, have evaluated progress towards the realisation of the ERA in the transport sector. It has identified the SWOT of, and to, research in this domain. Aspects evaluated include the specific barriers impeding the realisation of ERA in the fields of Mobility for researchers; World-class transport RIs; Strengthening research institutions; Sharing knowledge; Optimising research programmes and identifying priorities, and International cooperation. Recommendations given below in each of these areas considers the opportunities to overcome fragmentation. One immediate impact of this project is the reduction in the fragmentation of effort between the different transport research organisations involved in the project. This provides a sound basis for the strengthening of the ETRA, which will in turn strengthen ERA progress.

4.1 MOBILITY FOR RESEARCHERS

Mobility of researchers through the Marie Curie and European partnerships is absolutely critical for "passing the ball" around and between the European transport research team. This will improve the interaction between frontier and focused scientific knowledge. The training and education of a new generation of scientists, engineers and technical staff is important for academia, industry and policy-making institutions, but a key challenge is the creation of a new generation of professionals linked to the evolution of the transport system.

DETRA partners set out to define activities related to mobility and training in transport at a European level to prepare and train the next generation of surface transport scientists and professionals. This included identifying currently-implemented actions pertaining to researchers' training and mobility and analysing existing European projects related to these topics.

http://www.transport-research-job-careers.eu

Analysis of existing European actions and recommendations for improvements

Results of this analysis highlighted weaknesses, such as the lack of information about projects that favour researchers' mobility. This could be corrected by imple-

menting the EURAXESS platform, which should collect and advertise all European researcher positions. Within the transport field, this could also be solved by using the dedicated "Mobility web portal in transport" set up at http://www.transport-research-job-careers.eu by the DETRA project. This portal aims to gather PhD, post-doctoral and researcher positions from organisations that are members of the seven European entities of DETRA. In a second step it aims to advertise job offers to European universities, research laboratories, and enterprises working in the transport area.

Other projects, such as European Council of Doctoral Candidates and Junior Researchers (Eurodoc), have recorded some concrete hindrances to mobility and suggested some possible solutions. The DETRA project has tried to go further by analysing what went wrong and envisaged a lack of systemic approach in European mobility and training projects both at proposal stage level and project implementation. The lack of a common and shared approach in defining what is a "mobility and training project" and which outcome can be expected from it is a hot topic. The EU must face this topic if it wants to build a new generation of researchers.

Europe needs to adopt coordinated schemes requiring indicators to measure the "growth" of researchers within each project. Considering the importance attributed to researchers' mobility by the European Charter for Researchers, it could be useful to introduce among the parameters of European project evaluation a specific entry that considers positively the projects that provide some forms of mobility. A good example is found in the COST programme, where the evaluation of the proposal at both stages (pre-proposal and full proposal) provides specific criteria devoted to measuring the presence, participation and plans for further involvement of young researchers. One additional recommended action could be to ask for real feedback on the above initiatives, as well as a follow-up to be provided from the funding agencies.

A real policy for young researchers is still far from being satisfactory and at this point some good practices and examples should be supported by the EC. In particular, two good practices have been identified by this research. The first successful practices are the training sessions provided by the ECTRI-FEHRL-FERSI Young Researchers Seminar, where young researchers are supported and followed by senior experts (tutors) as they write high-level scientific papers and present them to expert audiences. The second practice is the organization of "brainstorming activities" (workshops) in which young researchers are asked to deliver specific outcomes on defined topics, in order to strengthen their ability to work together and interact on complex themes, covering various aspects and involving several areas of expertise.

"Mobility for Researchers" also included some methods and tools to improve training and mobility in transport domain (the design of a European PhD in Transport, and the organisation of an "ad hoc" training programme).

Design of a European PhD in Transport

First of all, a list of the following relevant European stakeholders working in transport research and training to be involved in the PhD design was drawn up:

1. Universities in charge of PhD programmes and providing high level courses
2. Research centres that host PhD students, allowing them to work actively in the research field
3. Network of Excellences (NoE) that encourage the training and mobility of researchers
4. Industries interested in capitalising on the researcher's results and suggesting which knowledge is important for their needs

Questionnaires on mobility and training and PhD activities were sent out to these stakeholders and the results have shown a high interest towards a profile of researchers. In fact, the majority want to be actively involved in training students and are keen to recruit "European Doctor in Transport" graduates. Very few institutions are not interested in this new profile.

The proposed format of the European PhD is not far from current practices, requiring at least the master degree to enter the PhD course through an admission process based on a selection with an oral examination. The length should be from three to four years with a variety in the credits to get, where 180 seem a reasonable choice. The focus of the PhD period should be mainly (> 70%) on the research activities with less time devoted to the training. A period abroad of at least three months should be provided, and an internship in an enterprise or research centre dealing with

the student's research matter is welcomed by most of all respondents.

The training programme should aim at developing the following main points:

- Acquisition of knowledge from the basic disciplines such as mathematics or statistics to tackle the complexity and to manage a complex system
- Acquisition of a specific and high-level knowledge through specialist courses at the doctoral level on the topics covered by the transport disciplines

The courses on data analysis, research methodology and epistemology, literature search methods, descriptive statistics and multivariate statistics, seem to be crucial as preparatory courses for this programme. This is because transport-related courses tend to focus on transport modelling, transport planning and transport economics. One important aspect to add to the PhD students training is the acquisition of experience in project management through the development of:

- Leadership capability, working in teams and the capability to integrate specific knowledge in a common framework
- The ability to manage discussions mediating several and contrasting points of view, to resolve conflicts and find good compromise solutions
- The ability to communicate and capacity to dialogue with the stakeholders and understand their point of view, translating it into a problem to solve

The training should provide a common vision and framework in transport research to face the current and future needs of the decision-making process in the transport sector that must be dynamic and ever changing to keep pace either with technological, societal or individual developments.

The annual advancement check of the students is considered to be very important and should be mainly assigned to the tutor/supervisor, while for the final defence the external supervisor is preferred. This final defence should include a written dissertation and an oral defence of the dissertation, most likely to be in English. The structure of the examiners board should include at least one member of another European country.

The most preferred format of the PhD follows some of the current guidelines. A standardisation in all EU countries of such a format could create some problems in the countries where there is a strict legislation, providing precise rules to manage the PhD. In the case where the regulation is in the hands of autonomous universities (such as in the UK), the eventual constraints could be different in respect to the proposed format. Of course, the ETRA could be the right "vehicle" to drive the partners towards a common objective, create a new generation of young researchers able to move across different countries without having problems related to different legislation or procedures. This would be also in line with the work already done at Bachelor and Master level with the Bologna process and this proposal could streamline the process at PhD level.

4.2 WORLD-CLASS TRANSPORT RIS

World-class European RIs are critical for the transport sector, not only for opening new frontier knowledge but also for preparing the answer to the political and/or societal challenges and addressing competitiveness issues. The types of investments here include new hard RIs as well as new soft RIs, particularly new databases from demonstrations, Field Operational Tests (FOTs) or scientifically adapted to the new challenges.

DETRA partners are convinced of the need to improve or create all the required RIs, hard and soft, and increase the research capacities complementary to the European Strategy Forum on Research Infrastructures (ESFRI) agenda. This issue is critical for the roadmap and implementation phase of the ERA Vision 2020 in the field of transport because of the international competitive advantages that it would offer transport European research.

http://detra.fehrl.org/facilities

The DETRA project identified ways to better utilise existing RIs in the transport sector by improving the network. This will increase and facilitate knowledge exchange amongst the scientists and experts working with these RIs. Actions that can be taken to facilitate networking include:

- Utilising the RI online catalogue developed as part of the DETRA project. The online catalogue (http://detra.fehrl.org/facilities) aims to provide an up-to-date overview of existing world-class RIs, both in Europe and internationally. It is also a tool for identifying missing RIs to address current and future needs
- Building a forum for knowledge sharing. It is recommended that it be built by already established organisations such as ECTRI, EURNEX and FEHRL. Creating common seminars/workshops focusing on topics related to the use of RIs could be one option. Establishing a common COST project that deals with specific topics could be another possibility

Apart from fully maximising the usage of existing RIs, there is a need for additional new common world-class RIs within Europe which can be summarised as follows:

1. To solve the common future challenges, e.g. climate change, globalisation, demographic changes, need for efficient transport and limited resources. The RIs will also be key drivers for innovation, knowledge exchange, research development and the economy
2. Financing of world-class RI is a key issue, and to be able to realise the necessary RIs it is important that the transport sector applies a new common strategy that focuses on a coordinated approach with cooperation between countries/researcher, open access RI and a common roadmap, contrary to the status quo which is fragmented and focuses predominantly on the local needs of each country
3. The need to facilitate strategic international cooperation for complex critical global RIs, ensuring their global access and interoperability with added value for the money spent

Within the DETRA project, four new RIs have been identified of great relevance to solving the future challenges in a coordinated approach. They are:

1. Naturalistic Road User Behaviour Centre
2. European Multi-modal Traffic (EMT) model
3. Resource Centre for European Transport Infrastructure Construction (ETIC) and performance data
4. European Road Infrastructure Testing (ERIT) facility

As highlighted in the separate DETRA report entitled "Transport Research Infrastructure Roadmap", two different roadmaps were outlined to implement these RIs.

1st Roadmap - ESFRI route

ESFRI produces and continuously updates a European roadmap on RI. Until now, transport-related RI does not appear in the ESFRI roadmap. A concerted effort should be made to ensure that large RIs associated with the transport sector form part of the ESFRI landscape. In order to achieve this, the following steps would be required:

I. *National research centres and universities, in association with national transport authorities, should initiate national dialogue on the need for major national transport-related RI to address current, emerging and*

future transport needs and initiate the drafting of strong motivations for these. Institutional actors such as CEDR, FEHRL, ECTRI and others for coordination at European level could also be used to initiate the process. National representatives on ESFRI should also be involved. The end goal is to ensure that transport-related RI features on national roadmaps.

II. *The drafting of ESFRI proposals for transport-related RI, derived from national and/or sectorial roadmaps, and subsequent endorsement of these proposals by an ESFRI delegation and/or by a Council of an EIROForum[3] member organisation before submitting to the ESFRI Executive Board.*

III. *Upon approval by the ESFRI Executive Board that the proposal can be subjected to the ESFRI review process, a Thematic Working Group would then be constituted and tasked to take the process further. It is essential that the champions for the proposal(s) submitted to ESFRI form part of this Working Group. This Working Group would be responsible for scanning the long-term scientific landscape in the field and assessing the scientific case as well as the technological and financial feasibility.*

IV. *If the outcomes of the Working Group are positive and endorsed by ESFRI, the RI would be listed on the ESFRI roadmap, which will certainly assist with the implementation of the RI. This, however, is not the end of the road, but rather the beginning of the implementation phase, which could be quite cumbersome (detailed design, including e-infrastructures; location of the RI, whether it is a single site or a distributed entity; establishment costs and financial sustainability; governance and administration; etc.).*

2nd Roadmap - 'informal' implementation

Other options for the implementation of new RIs should also be considered. One such option is to work through national structures and bodies such as CEDR and use the ERA NETs (ERA NET ROAD or ERA NET TRANSPORT) for the implementation of new RIs. Pooled funding could be raised for the development of concept documents and master plans for the implementation of ERA RI in the field of transportation, as well as for the financing of the implementation itself. The advantage of this approach is that the ERA NET member countries that agreed to sponsor the concept documents and master plans could essentially be the same countries that support the implementation of the proposed RI.

To succeed in sourcing financing for new large-scale RIs within the transport sector, it is essential that the transport sector first agree on the needs and prioritise the required RIs accordingly. A coordinated action including all transport modes are a key to success. Based on the results from the DETRA project, it should be possible to finalise such a statement and use this to approach ESFRI as well as other bodies.

A number of constraints are usually highlighted as reasons for not cooperating around RIs, but these are mainly the same issues dealt with in most research and development projects. Hence, it should not be too difficult to set out the rules for how these issues should be handled.

The recommendation is that the next steps be taken to establish both increased networking around existing RI as well as to develop new common RIs. In both cases, the first step, based on the results from DETRA, is to formulate a common view on the needs of RI (the why), the anticipated impacts (the results), the means of cooperation (the how) and finally the prioritised RI (the which). If these short summarised statements could be agreed upon by the transport sector (not only by a single mode), there will be a great potential to actually create the RI in the transport sector that could form the backbone of a strong ERA.

4.3 STRENGTHENING RESEARCH INSTITUTIONS

"Strengthening research institutions" focused on how research organisations in the different modes of transport have already adapted to ERA objectives and defines actions to become excellent research organisations (scientific excellence, relevance excellence, governance excellence) that provide high-quality world-class services by the middle of the 21st century.

Identifying how research institutions have already realised policies for overcoming fragmentation and integrating transport sector research in the ERA is an important issue for strengthening European research institutions. This first activity was followed by the identification of barriers causing weaknesses and/or characteristics that successfully contribute to strengthening research institutions. The resulting recommendations are based on the outcomes of workshops, previous work and discussion within the group and concerned stakeholders. Recommendations are accompanied by lead criteria and trends that permit a regular assessment of progress.

[3] ***EIROforum*** *is a partnership between eight of Europe's largest inter-governmental scientific research organisations responsible for infrastructures and laboratories to combine the resources, facilities and expertise of its member organisations to support European science in reaching its full potential(http://www.eiroforum.org/)*

The strengthening of research institutions is connected with the development and improvement of institutions in providing skills, competences and key enabling technologies. Therefore the development of Joint Research Initiatives (JRI), Joint Technology Initiatives (JTI) and Supportive Actions to foster skills, competences and key enabling technologies to strengthen research organisations and institutions for a more competitive industrial base make up a main recommendation of *"Strengthening research institutions"*.

The general recommendations to strengthen research institutions within an ERA network as a world-class player are strongly linked to the commitment to invest in research, a European scheme that drives national policy-makers to invest in ERA (e.g. matching funds initiatives) and engagement in international cooperation which will result in the participation in European projects, JRIs and the networking of international clusters.

Recommendations for strengthening research institutions lead to the following action points for European and national policy makers:

- Strengthening cohesion, knowledge sharing, scientific knowledge excellence, innovative scientific/industrial research base by fostering frontier to focussed/applied research to demonstration and prototyping through the development of JRI and Joint Programmes of Activity (JPIs)
- Actions to foster skills
- Joint programming should be further encouraged and expanded as a first step, with the:
  – Setting of common work programme content (avoiding overlapping etc) throughout the ERA
  – Common financing mechanisms and funds
  – Simplification of administrative procedures based on the principle that "rules are abided" until one organisation is proved (through ex post auditing) wrong
- Greater involvement of DG MOVE in specifying transport research tasks jointly with DG RTD and INFSO in order to include more policy-related research in the programme
- Concerning the NoE's, the EC should assess on a case by case basis whether past achievements, potential, EU added value and prospects of self sustainability justifies further funding under FP7. To foster an innovative step change character of research institutions by preparatory research led by academia/research institutions with roadmaps defined by industries
- Use of existing instruments like CSA to strengthen self-standing NoE entities and launch a competitive call where these NoE's/VCE's get support for moving further towards integration and ERA deepening/completion
- Inside the institution, the capitalisation of the experience of NoE draws on the fact that new research governance and management is part of the excellence as the relevance for our customers (public bodies, society, and industry)
- Outside the institution, besides the EIT and to accompany the research reforms including articulation between frontier and focused research there is a need to reinforce the research organisations (research corner of the Knowledge Triangle) as stated in the Lund Declaration
- Strengthening institutions through consolidation of networks, projects and infrastructures towards capacity building or research programmes

4.4 SHARING KNOWLEDGE

Knowledge sharing and dissemination of research results is a vital part of the strategy of transport research organisation. Objectives of the process are to support international cooperation, help their members to increase their efficiency and promote their role as a key player in the European transport sector.

The work conducted in the DETRA project examined the processes followed by the transport research organisations such as ECTRI, EURNEX, FEHRL, HUMANIST, ISN and NEARCTIS for sharing knowledge in terms of strategies and actions. Analysis has also been con-

ducted to identify the barriers and bottlenecks causing weaknesses of this process and preventing successful exchange of knowledge internally and externally toward other research organisations, industries in the transport sector and with the general public and civil society organisations.

Organisations have recognised that knowledge constitutes a valuable intangible asset for creating and sustaining competitive advantage. As one goal of knowledge transfer and exchange efforts is to influence decision-making processes, the knowledge that is produced and exchanged help organisations to make well-informed decisions about the various policies, programmes and projects in which they are involved.

The analysis has shown that knowledge sharing strategy is guided by the following theoretical principles:

- To reach the right people through their preferred channels
- To provide clear, relevant, accessible, on-time and "labelled" information
- To be open and honest at all the times
- To communicate in a cost-effective and sustainable way

Detailed analysis of the knowledge sharing and dissemination strategies followed by the DETRA partners showed this strategy is two-fold with internal and external communication activities.

1. Internal communication
   - A means of recognition and motivation
   - A means to improve the feeling of membership
   - A way to allow the members to communicate /exchange through well defined processes
2. External communication
   - To better inform the external world on activities developed by the transport research organisation
   - To promote the transport research organisation's achievements to key opinion formers at European and national level
   - To increase and promote the perception of the transport research organisation
   - To develop transport research organisation's opportunities
   - To foster the visibility of the transport research community

Several main issues have been identified for optimised knowledge sharing:

- Determining the target audience: tailoring the knowledge transfer and exchange strategy to the audience's needs, knowledge, and the sorts of practices they face on a daily basis is critical in an effective knowledge transfer and exchange activity
- Defining the type and the presentation of the message: how research or any type of findings and information are packaged and presented impact how readily the knowledge is to put into practice
- Choosing the relevant media/tools to support the process of sharing knowledge: Collaborative Working Environment (CWE), Knowledge Management System (KM System), physical meeting versus electronic forum, connection with social networks are the various means and tools used to share and to exchange knowledge. Advantages and weaknesses of each of these modalities have been discussed

The work showed that knowledge-sharing activities are generally supported by technology, however this constitutes only one of the many factors that affect the sharing of knowledge in the transport research organisations; the other factors can be culture, trust, and incentives.

One prominent obstacle of sharing knowledge is the notion that knowledge is property and ownership, a major challenge encountered by organisations is resistance to sharing by some of their members. To counteract this, transport research organisations must overcome this weakness by reassuring their members that they will receive some type of incentive for what they create. The risk in knowledge sharing is that members believe they are rewarded for what they know, not what they share.

The work concluded that nobody really questions the necessity and the relevancy to share knowledge in the area of transport research. Nevertheless, the process of knowledge sharing is time- and cost-consuming, and in practice it requires a real effort, first of all to gather the information and secondly to make it easily accessible to whoever is interested.

A Stakeholders Forum workshop was organised to discuss the recommendations for sharing knowledge in the future with relevant external stakeholders. An example of positive experience in the field was provided by representatives of SETIS (http://setis.ec.europa.eu/),

which is a system for sharing knowledge through the strategic energy technology information.

According to the main results of the work and based upon the workshop discussions, the following recommendations can be made:

- Supporting the growth of cooperation in research, accessibility and use of research results by increasing effort to support an effective process of knowledge sharing between the main key transport organisations
- Strengthening the position of key transport research organisations by improving knowledge sharing and dissemination of research results through incentive actions promoting dissemination benefits for each member
- Improving the process of sharing knowledge by supporting the development of electronic databases that gather knowledge from the various relevant transport research organisations
- Rewarding members for participating in sharing their knowledge for the benefit of the research organisations
- Promoting knowledge sharing and removing knowledge sharing obstacles to encourage discovery and innovation through the creation of an organisational culture among research transport organisations
- Fostering the setting up of common and/or compatible tools to manage the knowledge-sharing processes between the key European research transport organisations in order to sustain competitive advantage at an international level

Although implementation and knowledge transfer has been demonstrated among DETRA's partners as being a priority, the process can be improved upon in the framework of the ERA-T as one of the Grand Challenges. Most institutes indicate that both transfer of knowledge and subsequent implementation do not happen spontaneously and requires effort. The process can be stimulated with tools that increase the availability of research results and interest/involvement of fellow researchers. Indeed, through their links with industry and notably through their roles in many ETPs, DETRA partners are and will continue more heavily in the future to be engaged in developing effective knowledge-sharing between policy makers, public and private research, industry and society.

4.5 OPTIMISING RESEA RCH PROGRAMES AND IDENTIFYING PRIORITIES

Within the context of the DETRA project, significant emphasis was placed on well-coordinated research programmes and priorities, including a jointly-programmed public research investment at European level involving common priorities, coordinated implementation and joint evaluation. This was the objective of *"Optimising research programmes and identifying priorities"*. This goal was initially pursued by a survey on the existing research programmes and roadmaps developed in single European states at the EC level as well as internationally (e.g. in Japan, USA), related to all areas and modes of transport. The purpose of this process was to collect all the research priorities for each transport sub-area that concerned any existing or emerging gaps for any transport mode.

More than 60 such research priority recommendations and/or roadmaps were analysed, stemming from several types of organisations such as the ETPs (e.g. ERTRAC, ERRAC), research institutes associations (e.g. FERSI, ECTRI, FEHRL), industrial associations (e.g. EUCAR, CLEPA, ACEM) and citizen representative organisations (e.g. POLIS, FIA, FEMA). Special emphasis was given to the EC roadmaps and documents, for example the *"White Paper - Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system" and the "Europe 2020 Flagship Initiative Innovation Union"*.

The collection of these materials was followed by the classification and categorisation each research document using a common template, according to the four major categories of transport designated at the beginning of the DETRA project (Safety & Security, Congestion & Capacity, Environment & Energy, Globalisation). In addition, this template helped the key elements of the documents to be analysed.

Safety & Security

Congestion & Capacity

Environment & Energy

Globalization

Research Priorities

Starting from these four key areas that constitute the backbone of the DETRA project, and according to the information collected by all the documents analysed, a list of research priorities has emerged that contains around 20 research areas and nearly 90 themes. This categorisation of transport research priorities concerns all transport modes (road, rail, maritime and aeronautics) and reflects their research needs. For each of these themes and modes, research priorities were extracted which reflect a balance between consensus topics among most stakeholders and emerging promising concepts and technologies proposed by some stakeholder groups. This is not THE ultimate set of research priorities in the surface transport domain for the future, but significant input towards it to be further discussed and used as a reference document by the relevant research platforms and EC services that will ultimately decide which of them to follow and under which time scales.

Transport Research Work Programmes and Roadmaps Database

The determination of Research Priorities also provided the structure of the "Transport Research Work Programmes and Roadmaps Database" which was developed for the collection, sorting and analysis of the research programmes and roadmaps.

http://detra.fehrl.org/index.php?m=39

The objective of this database was to provide a tool which will facilitate the detailed and clear presentation of all the relevant research documents. In this web-based tool (http://detra.fehrl.org/index.php?m=39), anyone can search for the documents that they are interested in, as well as suggest further documents regarding research priorities and roadmaps in transport.

Towards a Modular, Pan-European Transport Research Programme

The final outcome of this whole process, as mentioned above, is the development of a single trans-European Transport Research Roadmap containing all the relevant research priorities for each separate field of the transportation research area. A first draft of this document has already been prepared, presenting the main research priorities of the road transport area as far as the sectors of Safety & Security, Environment & Energy and Congestion & Capacity are concerned.

This first draft of the *"Optimised pan-European Transport Research Work Programme, Roadmap and priorities"* has been developed by the analysis of the various transport roadmaps and work programmes derived mainly from EU research and industry organisations. Based upon the benchmarking of database results, a set of commonalities and differences between the different transport research work programmes has initially been structured. These commonalities and differences have been obtained relying on the research areas presented above.
More specifically, during the analysis of each document, emphasis was given to the research needs and priorities described in it, which were related to the different domains and sub-domains of the surface transport area. All these research needs and priorities were categorised according to the research area list defined in the DETRA project and, using this procedure, a set of commonalities were established that concern all the same or relevant needs and requirements that have been designated by the several different organisations as far as the fields of the whole surface transport domain is concerned.

The work concluded that transport research in Europe seems to be at a crossroads. Individual technologies (i.e. on ICT) have matured and vehicle/vessel construction has seen significant improvements in terms of safety and capacity. And although several mode-specific research topics exist, the common transport research trends are being formulated across the following axes:

- Environmental protection and security aspects have formulated the two highest recent priorities and will continue to dominate in the near future. Nevertheless, relevant technologies will have to be researched

in combination to other key priorities, such as safety, capacity, accessibility and cost-efficiency
- Technologies to prioritise further research globally include electrification of transport, cooperative systems and application of new materials and micro/nano sensor technologies
- As key services to develop across modes, highlights are seamless traffic management, personalised info-mobility services and effective training of users and stakeholders
- The two major challenges for future research are the integration of transport services through seamless and integrated multimodal services (with "one stop shop" info and ticketing support), as well as pan-European wide interoperability (through de facto or de jure standardization)
- Harmonisation and standardisation research actions need to focus upon systems certification, accessibility of overall service chains to all citizen categories and communication/charging protocols and standards to enable ICT and alternative fuel technologies to gain rapid market penetration
- Evaluation related research is moving in all fields towards large-scale FOTs and naturalistic behaviour experiments.

Europe is now the global leader in the maritime sector and in a good position in the road and rail areas. It is now time to exploit technological breakthroughs through large-scale integration, pan-European instantiation and application and ultimately standardisation and harmonisation; to derive to the set political aim of Europe becoming the leading player worldwide in the transportation domain

4.6 INTERNATIONAL COOPERATION

Consultations and lessons learned from project partners and European and international research partners as well as stakeholders, ETPs and governmental organisations (US Department Of Transportation (DOT)/ Federal Railroad Administration (FRA) Russian Federation etc.) resulted in the definition of good reasons, objectives and expected mutual benefits of international cooperation with suggested methods to maintain Europe's competitive edge. A common strategic and sustainable approach to increase the level of international cooperation mainly in the areas of global & societal challenges and resulting specificities, while at the same time protecting common European interests, is essential to help provide long-term perspective to stay competitive, enter new markets and keep pace with developments taken place elsewhere.

International Cooperation and competition simultaneously ongoing can be known as "Coopetition" and are key aspects to raise the level of scientific excellence, addressing global challenges and creating a more dynamic and competitive sector.

"International Cooperation" built on previous work undertaken in the CETRRA, SIMBA 1, SIMBA 2 projects and considered the documentation of the "EU-US Transport Research Collaboration". The work consisted of three major tasks:

- Evaluation of the scope, status and success so far of international transport research cooperation
- Definition of barriers and constraints, best practice and perspectives in the context of the future ERA
- Recommendations on improvements to ERA supporting world-class research within international transport research cooperation and the prioritisation of mutually-agreed research topics

This work concluded that the current status of International Cooperation in science, technology and innovation (STI) has not yet reached an adequate level as identified in the objective of the EUROPE 2020 Innovation Union, while at the same time protecting common European interests. There are indications that Europe is losing its attractiveness as an international research partner and the steps the EU and Member States need to take to combat this are four-fold:

- Develop a common strategy and priorities for Research and Innovation (R&I) and international STI cooperation, in particular to tackle global societal challenges
- Make considerable effort in further information and intelligence gathering to conduct the strategic assessment of potential partners and identify possible mutual interest and synergies between target countries and European capacities
- Overcome the fragmentation of Europe's research landscape both within and across the transport modes
- Strengthen the excellence of Europe's research landscape, as well as knowledge sharing and added value for the money spent

Far from having one "national" identity, the EU and Member States must improve the following effective integrating mechanisms to facilitate cross-country collaboration:

- Education and training of the scientists and engineers of the future
- Dissemination material in local languages
- Following an international cooperation roadmap model, including the main enabling technologies with the support of policy makers and investments
- More emphasis on researcher mobility
- New culture of cooperation where researchers take on the main responsibility of starting to overcome fragmentation, foster knowledge sharing, harmonisation and standardisation
- New challenges of transcontinental transport projects such as the EU-Asia Land Bridge with a cooperation on a global level and need for strategic reflections and decisions of a higher order

Recommendations to improve ERA supporting world class research need to focus on a sound market analysis, benchmark and lessons learned concept, building critical mass and risk and revenue sharing for the global and societal challenges jointly to be solved. They also follow the central objective of the EC 'Horizon 2020' to achieve a transport system that is resource efficient, environmentally friendly and safe and seamless for the benefit of citizens, economy and society.

Main drivers for international cooperation in transport R&I are acknowledged to be:

- Global challenges, common problems
- Cross-border interoperability
- International standards and global systems
- Access to knowledge, access to markets

The EU transport policy objectives that tackle the global and societal challenges consider international cooperation as a strategic issue to be covered in a holistic approach, in areas covering all modes of transport and multimodality for:

- System operation including Systemic approach, multimodality & integrated system management
- Environmental and societal impacts of transport
- Environmentally friendly vehicles and energy sources
- Demand management and traveller information

Strategic and operational recommendations will together provide the groundwork and critical mass for the stakeholder and EU/partner countries to build the framework for successful international cooperation to lead to in concrete thematic issues.

Some of these functional and concrete specificities in the EU and cooperation partner countries, eg. USA and Russia, have been identified in the areas of:

- Provision of resilient infrastructure (Forever Open Road (FOR) and FOR x 4 programme)
- Electrical vehicles (High-tech batteries, inductive charging)
- Further Integration of Transport Systems across and within modes
- Sustainable environmentally friendly transport systems with
  - USA-Europe interests and thematic issues eg. HiRel High Speed Train/ Infrastructure & Urban mobility
  - Russia-Europe interests and thematic issues eg. Low maintenance infrastructure, Highspeed Rail for densely populated central areas/ industrial regions, resilience to adverse weather and EU/Asia Land Bridge

The overruling and stabilising criteria for successful International cooperation to run smoothly from research to market uptake will be the definition of mutually agreed needs, demands and challenges by the partners and other European stakeholders. This includes clearly defined objectives and principles for the collaboration of appropriate institutional structures and processes to be put in place and credible "champions" of a trustful partnership.

5 THE ALLIANCE (ETRA)

Throughout the DETRA project, partners have been increasingly convinced of the need for an Alliance which would build on the key outputs of the project outlined in chapter 4. At the beginning of 2012, a proposal on the 'ways and means' of the ETRA was developed and discussed at DETRA's final integration conference at TRA2012 in April 2012.

The ETRA is planned to be a voluntary grouping of partner organisations coming together for the deepening of the ERA-T through the exchange of information and sharing of positions on areas of mutual interest.

It shall provide a forum for coordination between the partners. It is not expected to manage or subsume its partners. Partners remain free, and encouraged, to develop their own position papers and develop their unique views. However, the benefits of cooperation between the Alliance partners will provide them with a more powerful collective voice and the efficiency benefits of reducing duplication, and give the highest visibility to the transport research community and its potential contribution in supporting policies issues.

5.1 OBJECTIVES AND PURPOSE OF THE ETRA

The main objective of the Alliance is to provide a platform through which the main transport research organisations can work together on topics of mutual interest and coordinate their efforts towards the full realisation of the ERA in the field of Transport.

The objectives of the Alliance are to be realised through the following:

a) Providing a structure for the interchange of knowledge and making joint efforts to foster research results through to their full implementation
b) Promoting the setting of joint transport research priorities and coordinating research programmes and initiatives
c) Promoting cooperation in all relevant areas – starting with its partner organisations - and, where possible, developing cross-modal and interdisciplinary joint research activities (including JRIs)
d) Preparing common position papers (e.g. SRA, road maps) on key transport related issues for added value to the transport users and the community as a whole
e) Joint strengthening of the European research expertise, research infrastructures and mobility of researchers through specific joint actions and initiatives
f) Promoting the uptake of European transport expertise and innovation internationally and vice versa
g) Supporting the continued development of TRA as the major European and international conference bringing together all stakeholders in the sector,
h) Other related initiatives as necessary

5.2 STRUCTURE OF THE ETRA

The Alliance will be composed of the appropriate partner organisations necessary to achieve its goals. Applications for partnership may only be accepted from entities based in EU and EFTA countries whose main focus is transport research and its application. Such organisations shall include members from at least five (5) EU/EFTA countries. The objective is therefore to widen the network of research entities involved. The objective is therefore to widen the network of research entities involved.

6 PARTNERS

The partners who developed the DETRA project and plan to join the Alliance are:

6.1 ECTRI

ECTRI, the European Conference of Transport Research Institutes, is an international non-profit organisation that was founded in April 2003. Its members are major transport research institutes or universities from European countries. Together they account for more than 3,000 European scientific and research staff in the field of transport. ECTRI aims to help building the "European Research Area" (ERA) in surface transport by cooperation in thematic and process oriented working groups, task forces, Framework Programme projects and seminars. More information about ECTRI can be found at: (http://www.ectri.org).

6.2 EURNEX

EURNEX , the European rail Research Network of Excellence, was created in January 2004, and has been turned successfully into a self-standing legal entity since November 2007. EURNEX Association comprises 48 universities & research institutes in the area of transport and mobility in EU 27 member states and Russia with 600 researchers. EURNEX is providing multidisciplinary R&D, organised in user-driven scientific poles of excellence. EURNEX is the first research cluster of excellence to underpin the ERA in the rail sector by integrating a fragmented research landscape, promoting the railway contribution to sustainable development and improving the competitiveness and economic stability and educating and training high-quality scientists and engineers for the European Rail Sector. More information about EURNEX at: (http://www.eurnex.net).

6.3 FEHRL

Formed in 1989 as the Forum of European National Highway Research Laboratories, FEHRL provides a coordinated structure for the interests of the thirty-plus national research and technical centres in Europe and internationally. FEHRL's aim is to encourage collaborative research and information exchange between European Laboratories and Institutes in the field of road engineering as well as to provide relevant knowledge and advice to governments, the European Commission, the road industry and road users on related technologies and policies. FEHRL is engaged in road engineering research topics such as safety, environmental issues, telematics, bridge and pavement engineering and geotechnics. More information about FEHRL at: (http://www.fehrl.org).

6.4 FERSI

The Forum of European Road Safety Research Institutes (FERSI) was established in 1991 with the objective of encouraging collaboration between European road safety research institutes. Such collaboration was, and continues to be, necessary to ensure that the problems of road safety in European countries are researched by the best available expertise, and that the results of the research are implemented in the most appropriate and effective way, both at national or at European level. Prior to becoming a legal entity in 2011, FERSI was represented by the President from CERTH/HIT. More information about FERSI can be found at: (http://www.fersi.org).

6.5 HUMANIST

The goal of the FP6 HUMANIST Network of Excellence (NoE), supported by ECTRI and FERSI, was to promote a Human centred design approach and also to federate research in its scientific domain, by creating a European Virtual Centre. The creation of the virtual centre was an answer to the scattering of research capacities in Europe. This has been done by setting up strong connections between partners inside the NoE. The relationship with Universities and Academic World outside the NoE were not set aside, and were enhanced through training programmes and welcoming young researchers. Outputs from NoE were also targeted toward other relevant stakeholders such as National and European public authorities, Standardisation Bodies, National and European RTD Projects. Diffusion and transfer of knowledge, in addition to common partnerships between NoE and these entities ensured flow of information in order to disseminate the concept of Human centred design outside the Network. Such a diffusion of information ensured the effectiveness of the expected impacts. The HUMANIST Network of Excellence ended in February 2008 and is now continuing its activities under the status of a Virtual Centre of Excellence created as an international association. More information about HUMANIST NoE at: (http://www.noehumanist.org). More information about HUMANIST VCE at: (http://www.humanist-vce.eu).

7 CONCLUSION

Developing the ERA-T requires a step-change in cooperation between research organisations. The sector is too fragmented and therefore a European Transport Research Alliance (ETRA) between the key organisations was promoted to consolidate the gains made in the DETRA project. The partners, ECTRI, EURNEX, FEHRL, FERSI and Humanist have agreed to form the core of such an Alliance. Other European organisations representing appropriate transport research competence and consisting of a membership from several states may be able to join.

The Alliance will focus on the objectives of:

- Mobility for Researchers
- World-class transport RIs
- Strengthening research institutions
- Sharing knowledge
- Optimising research programmes and identifying programmes
- International Cooperation

The specific objectives of the Alliance are to be realised initially through the following:

a. Providing a structure for the interchange of knowledge and making joint efforts to foster research results through to their full implementation
b. Promoting the setting of joint transport research priorities and coordinating research programmes and initiatives
c. Promoting cooperation in all relevant areas – starting with its partner organisations - and, where possible, developing cross-modal and interdisciplinary joint research activities (including JRIs)
d. Preparing common position papers (e.g. SRA, roadmaps) on key transport-related issues for added value to the transport users and the community as a whole
e. Joint strengthening of the European research expertise, research infrastructures and mobility of researchers through specific joint actions and initiatives,
f. Promoting the uptake of European transport expertise and innovation internationally and vice versa
g. Supporting the continued development of TRA as the major European and international conference bringing together all stakeholders in the sector
h. Other related initiatives may be proposed as necessary