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EXECUTIVE SUMMARY

Introduction The present document aims at producing a comprehensive set of recommendations for putting in place an efficient framework for international cooperation in the field of transport research (and in many aspects for any research field).

The framework presented in this document has been developed by putting together the results of extensive and intense workshops, surveys and interviews as well as reviews of current activities on international cooperation, involving hundreds of individuals and organisations. During the two years of its duration, the EUTRAIN consortium organised four “regional workshops” in Athens, Beijing, Sao Paulo and Moscow with participants from their wider regions i.e.: the Mediterranean, Australasian, South America, and CIS/Black sea regions countries respectively.

Furthermore, the EUTRAIN consortium members also visited several individual countries such as China, Japan, U.S.A., Egypt, Algeria, etc. During these visits, the consortium members carried out comprehensive surveys through questionnaires, interviews and focus groups meetings. These surveys collected local stakeholders’ needs and interests, priorities, as well as assessments of current international cooperative projects’ practices and policies. All the material that resulted from these activities together with existing experience and know-how (e.g. through the results and recommendations of projects such as: CETRRA, DETRA, SIMBA, SIMBA II, VIAJEO, STADIUM, SOLUTIONS and Viajeo PLUS), and the consortium’s own research and experiences, has been the main background to form the recommendations presented in this document.

The Challenges faced International research collaboration has to deal with specific issues and is faced with difficulties such as cultural differences, language barriers, different project management and funding regimes as well as instruments, etc. In FP7 and FP6 projects dealing with international cooperation issues, it was shown that participation of international partners as consortium members is – in most cases - quite essential to the success of the project or research being performed. However, many organisations involved in international cooperative research work have difficulties to fulfil the necessary administrative requirements and are in several instances unable to efficiently use the available resources.

International cooperation activities also face resource challenges in Europe, too. Since some European countries are still in recession or on slow recovery, the importance of supporting international cooperation work may not be highlighted by policy makers and supported by the public. In other words, in some countries there may be growing a sentiment arguing in favour of research funding and sponsoring research in Europe rather than internationally. Moreover, the industry - particularly SMEs - may not recognise the benefits of international cooperation and therefore, may not be so keen to join and contribute to international cooperation activities.

***Mechanisms of
setting priorities
and topics for
future
international
cooperation
projects***

Collecting and assessing the needs and priorities as regards Topics and programmes of research on behalf of the recipient countries/ regions is of paramount importance and for this reason a more permanent mechanism has to be established, through which the relevant Commission services will be able to monitor the general trends, needs and priorities for transport research funding in specific target regions and/or countries. This mechanism as suggested in our recommendations could take the form of an *Observatory* (see recommendations section) but also due account should be taken of the relevant suggestions and position papers of the involved multi-stakeholder initiatives or transport research Associations that do have experience from international cooperative research programmes.

As regards the type of projects suited for international cooperation work, these must provide for "simplicity" and "flexibility" in order to suit the different organisational and financial frameworks that exist globally. While using Coordination and Support Action types of projects is a rather successful practice, the funding schemes to be used could well be improved as compared to the FP7 practice. A rather more suitable type of funding scheme could be something similar to the one used for the 'Thematic Networks' *Competitiveness and Innovation Framework (CIP)* projects. Such funding scheme has:

- Fixed rates based on the duration of the project and number of partners; For example 300 Euro per year per beneficiary for the first 10 beneficiaries;
- Personnel cost acknowledged to the coordinator only, for reporting and organising meetings;
- Other partners only receive fixed Lump Sums for general expenses; and
- Only the coordinator is required to submit a financial report.



Such a practice can significantly reduce the administrative burden to the participants, thus enabling partners to focus on the real contents of a project rather than spend resources on administrative and financial reporting, which is often more difficult for international partners since different countries may have different financial management and accounting systems. Moreover, such projects may cover longer time periods, e.g. 5 years instead of 2 or 3 years of the current Coordination and Support Actions projects in order to provide continuity and long-time reference frames.

The key word in the funding and administration function of international cooperation projects should be "simplicity". This has been particularly underlined by researchers from even well advanced countries, who get increasingly discouraged from participating in EU funded research projects, either because of the sheer complexity of the rules or because of not getting in time all the required elements for participation. A project should not cover too wide range of topics or too wide range of regions. For example, if a project covers topics ranging from road, railway, air to waterborne transport and regions ranging from developed countries to emerging market countries, the project may not be able to deliver outcomes for all topics and all regions at the same quality.

Recommendations on future joint programs, funding schemes and project management

Transferring the European *Joint Programming Initiative (JPI)* experience to international cooperation would be a potential mechanism to establish a more committed and more in depth international research cooperation in transport across the world. The following principles in developing European JPIs have been found well suited for potential future International JPIs:

- i. *Variable geometry of each IJPI and open access*, i.e. based on the needs and configurations of each particular country or grouping of countries.
- ii. *Structures that increase the efficiency and effectiveness* of the participating States' ability to deal with the large-scale socioeconomic challenges and problems of the future;
- iii. *Voluntary in nature*, i.e. participation to be based on the simple recognition of the practical usefulness of what is being proposed;
- iv. *"Supervision" by a trusted neutral Organization* or network of Organisations as a mechanism of "triggering" and monitoring;
- v. *Streamlined and simple implementation*, i.e. without unduly complex and lengthy management procedures at all levels;

- vi. *Short turnaround times* from research proposals to research results;
- vii. *Managerial Flexibility*, e.g. in allowing the possibility to choose, within a range of managerial reference models, the option considered most suitable in the specific case and circumstances;
- viii. *Uniform and objective evaluation* procedures, applied to all levels and stages according to specifications and appropriate benchmarking;
- ix. *Openness to change and evolution*, so as to maximize the benefits that could be derived from the experience to be gradually gained in running actual JPIs; and
- x. *Low administration overheads* by all categories of actors involved.

Furthermore the success of the introduction of International **JPIs** in practice would depend on the existence of certain necessary "preconditions" which are the following:

- A. *Harmonisation* at least to a certain acceptable level of similarity, of research organisation and management structures, i.e. more harmonised research governance in the cooperating countries. The idea is to create some well accepted "standards" for research governance and then work towards having countries adopt these "standards" through the adoption of some sort of international convention, or by promoting such standards through bilateral negotiations as part of bilateral scientific agreements. In both alternatives if the EU could get the support and cooperation of other "research developed" countries, e.g. the US, the chances of quick success would increase substantially.
- B. *Funding*: This is a more difficult area to handle and a more sensitive issue because countries will not be willing to commit to specific guidelines that may have financial implications for them. Nevertheless, funding is one of the major stumbling blocks and some uniformity in the ways of decision making, planning and committing funds for International Joint Programming projects must be achieved.
- C. Existence of a "*Neutral*" *supervising and monitoring Organisation*: Finding a "neutral" Organisation that would - at an international level - monitor and provide guidelines for International Joint Programming initiatives, is a major difficulty. Such "neutral" organisation would play the role of the coordinator Organisation (e.g. the Groupe de haut niveau pour la Programmation Conjointe - GPC of the European Research Area Committee - ERAC as

operating within the EU's JPI practice). It is felt that at international level such "neutral Organisation" can be found in the frame of one of the United Nations Institutes or specialised Agencies (e.g. UNESCO, or United Nations Development Programme - UNDP, or even UN "Institutes" such as the Institute for Training and Research - UNITAR or other appropriate UN agency). Alternatively, some well-developed regional or international NGOs should also be considered.

- D. In producing sufficient recognition of common challenges and priorities in the cooperating areas, the establishment of a common permanent mechanism for monitoring trends in the research needs and in defining common challenges and priorities is being recommended in the final recommendations section (chapter 7).
- E. Finally, there is the issue of dealing with the limited financial and human resources capable of handling the complex managerial and scientific tasks in order to have "balanced" participation in the JPIs i.e. projects with teams that represent a "balanced" involvement of all sides in the initiative (or rather "relevant to each participating country's GDP or some other measure of economic strength and capability"). The guidelines that should be worked out as suggested in (A) and (B) above, should clarify this issue too.

Given the difficulties and uncertainties inherent in an international multilateral joint programming initiative, it is suggested to try and establish one first International JPI involving the EU and 2 or 3 other countries. These countries could be found among those that already share common research ethics and research structures with the EU. The following topics could potentially draw enough support for such first

JPI:

- I. *Sustainability of surface transport*, maybe limited to urban areas only (i.e. dealing with the issues of urban congestion, air pollution, clean cars use and environmentally aware traffic management);
- II. *Maritime transport* with emphasis on anti-pollution and safety and security issues;
- III. *Climate change*: transport related adaptation and mitigation measures.

***Global research
infrastructure –
information and
data sharing***

The findings from current examples on shared RI and the feedback received from Organisations and researchers that were interviewed, point towards a roadmap for RI cooperation comprising five levels, as explained below:

Level 1 (*Explanation of need and benefits of cooperation around RIs*), is to explain the needs for and the benefits of RI cooperation. This may sound simple, but before organisations are able to identify the potential for cooperation around RIs, they have to be convinced of its necessity. The following actions are recommended:

- Increase experience by participation in international projects and networks of excellence and/or become members of umbrella organisations;
- Allocate funding to contribute to the cost of participation;
- Raise interest by presenting positive examples and highlight their benefits.

Level 2 (*Sourcing of partners through database searches*), is aimed at creating awareness of the existence of world-class RIs in the international research community, in order to foster possible cooperation. A possible way of raising awareness is through the development of an RI database containing world-class RI addressing all transport modes, e.g. by further developing the FEHRL RI Online Catalogue and rendering this database accessible to the research community.

Level 3 (*Establishing networks around special research topics*) involves initiating formal cooperation and building a climate of trust and understanding between Organisations and researchers in order to facilitate the sharing of information, knowledge and experience. Only in such a climate will, sharing of results between partners is possible. The goal to be reached at this level would be the creation of a **pool of expertise founded on mutual trust**.

Level 4 (*Sharing knowledge and experience*), aims at the further development of existing methods (and their validation through round-robin testing) and the exchange of knowledge and experience by the exchange of staff or by having joint workshops / seminars / courses.

Level 5 (*Collaboration through common RIs*), comprises the establishment of **common projects around at least one RI**, where the RI forms an essential basis and common resource for a project.

It is also recommended that an **International RI Task Force for all transport modes** be established to formulate recommendations and promote actions for networking and for information and knowledge

exchange on world-class RIs, and to identify requirements for new RIs linked to the Grand Challenges in particular. If the conditions are ripe this RI Task Force should create a Working Group on RIs (WGRI). This Working Group should have as its purpose to investigate the issues and instigate coordinated actions for the development of new RIs. The WGRI should provide recommendations on the selection of which RIs to promote by priority and submit those to the RI Task Force. In the main EUTRAIN report the particular tasks of this WGRI are also given.

It is finally imperative that large, critically important transport-related RIs be incorporated in the short term future in the ***European Strategy Forum on Research Infrastructures (ESFRI)*** roadmaps (transport-related RIs do not feature in current roadmaps).

***Research
training and
human
resource issues***

The need for systematically improving the human capital that is involved in transport research, especially in terms of its involvement in international cooperation research projects, is quite self-evident. A number of recommendations have been generated for training and human resource issues, the most eminent of which (as well as the most practical) are presented below.

1. *Reform of the Marie Curie funding process* related to funding of the supervisory aspects of the hosting institutions in European funded support programmes, increasing the allowable percentage of commercial work that an EU supported researcher can undertake for the institution they are working for, funding structured mentoring, considering increased incentives for stronger and more commercial European research institutions participation and others.
2. *Creation of a Researcher Database*. This would provide data and CVs of suitable researchers for organisations looking for such skills and vice versa (i.e. potentially offering skilled researchers).
3. *Systematic web-based training of transport researchers* (with emphasis on international cooperative work), based primarily on the use of on-line (remote) education tools like webinars or other internet based tools.
4. *Organisation of Short courses and training workshops*. With some relatively moderate funding for visiting lecturers and for the participation of the trainees, special "training" workshops can be organised to provide participants with state-of-the-art case studies or new knowledge and know-how on specific subjects.
5. *Researcher exchange programmes*. The mobility of researchers is a key instrument of international cooperation that should be

integrated in the Commission's strategy for international Science, Technology, and Innovation cooperation.

***Harmonizing
Institutional
cultures and
governance
regimes***

Institutional cultures and governance regimes are specific issues of primary importance for international cooperation according to the current experiences. The importance of Institutional culture lays in the profound impact it has on the work environment and the ability of members of an institution to succeed. Institutional cultures in the "future world class level research institutions" should be more aligned towards a strategic typology —focusing on global challenges, with integrated vision, and extensive networking.

Establishing *an International Cooperation Promotion and Networking Centres (ICPNC)* is proposed in order to foster international cooperation actions and build human capacities in transport research. Institutional cultures in the "future world class level research institutions" should be more aligned towards a strategic typology —focusing on global challenges, with integrated vision, and extensive networking.

Key members of ICPNCs could be identified and those key members could be surveyed in order to understand their institutional culture and potential obstacles caused by such culture in ICPNC.

The second step would be to raise awareness of such difference among key members in order to facilitate discussions on how to address the difference. It should be noted that few transport researchers have a broad view on either institutional cultures of different types of organisations (e.g. public or private, local or national) or similar organisations in different countries.

Future governance regimes and policymaking competencies could be gradually re-aligned and adapted to a more cooperative regime at the multinational level in terms of internal organisation, new political agendas setting, decision making regulations, and implementation procedures, and other relevant areas. Such process of change could be assisted by the creation and operation of a Conference of Global Research Cooperation (CGRC) i.e. a new international Organisation that should be created to act as the body that promote a more harmonised research governance and incorporating the ICPNCs.

The following possible steps may also in achieving greater harmonisation of research cultures and governance regimes:

1. Further investigating the problems and mobilizing commitment to change, through joint diagnosis of these problems focusing on those that hinder cooperation between countries with institutional cultures and governance regimes, in order to adapt organizations to cooperate.
2. Develop a shared vision of how to organize and manage global (transport) research cooperation.
3. Foster consensus for a new vision of (transport) research, gather competence to enact this new vision, and achieve cohesion to move it along globally.
4. Spread revitalization spirit to all parties involved in the countries of interest avoiding to adopt a scheme in which "funding" countries are "imposing" their views on "recipient" or "lesser research oriented" ones.
5. Institutionalize revitalization through formal research policies, systems, and structures.
6. Monitor and adjust strategies in response to problems in the process of harmonization.

***Intellectual
Property Rights
and
International
Cooperation***

The EC's financial support to international standardisation activities is essential, taking into account that the current economic situation that does not allow industry to invest much into international standardisation. The current practice to support standardisation through coordination and support actions projects has been acknowledged as an efficient way, but the dissemination activities could be significantly reduced. It has even been proposed that such projects may not include general dissemination activities at all, in order to focus primarily on standardisation activities. They should be carried out by key industry players, with participation also of major research Organisations. To be eligible to participate in such projects, pre-agreements with standardisation organisations and international partners should be required. Partners of such projects should be experienced in international standardisations and ideally have been members of relevant working groups or of standardisation organisations.

The European Research Area Guidelines on Intellectual Property (IP) Management in International Research Collaboration Agreements between European and Non-European Partners propose three main elements of an effective system to protect and exploit IP:

- a system that enables the protection of IP (e.g. patents, copyrights, brand, industrial design) that includes clarity about the ownership of

IP rights, rights to use IP, the rights and freedom of parties to transfer (assign) IP and the freedom to publish;

- a technology transfer framework, preferably with the provision of specialised knowledge transfer offices with professional staff;
- a fair law enforcement system in partner's countries that caters for dispute settlement but also that can award penalties and sanctions where appropriate.

The US FHWA Transportation Research Program Administration in Europe and Asia has analysed the issue of intellectual property rights in international collaborative research:

Addressing IPR is a common practice that facilitates the delivery of transportation research results. Europe has a decidedly different perspective than the United States on the ownership of intellectual property generated from government-funded transportation research. IPR is addressed before the transportation research is initiated and included in the research partnership contract. In general in Europe, development is seen as an opportunity to build a business based on the specific IP, creating an economic engine for the country.

Recommendations for a future international cooperation framework

In the conclusions and recommendations section of this report a number of concrete recommendations are given based on the results and findings of the previous chapters. The reader is recommended to read the whole of chapter 7 below as any summary of it here would reduce its value and substance.

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ABBREVIATIONS AND TERMINOLOGY

BRICS	Brazil, Russia, India, China and South Africa
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
CIP	The EC's Competiveness and Innovative Programmes
CRRI	Central Road Research Institute
CSA	Coordination and Support Actions
CSIR	Council for Scientific and Industrial Research
DETRA	Developing the European Transport Research Alliance
EC	European Commission
ECTRI	European Conference of Transport Research Institutes
ENP	European Neighbourhood Policy
ERAC	European Research Area and Innovation Committee
ERA-T	European Transport Research Area
ERRAC	European Rail Research Advisory Council
ERTICO	European Road Transport Telematics Implementation Coordination Organisation
ERTRAC	European Road Transport Research Advisory Council
ESFRI	European Strategy Forum on Research Infrastructures
ETSI	European Telecommunications Standards Institute
EURNEX	EUropean rail Research Network of Excellence
FEHRL	Forum of European National Highway Research Laboratories
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
GPC	High Level Group on Joint Programming
ICPC	International Cooperation Partner Countries
ICPNC	International Cooperation Promotion and Networking Centres
INCO	International Cooperation
ISO	International Standardisation Organisation
JPI	Joint Programming Initiative
NAE	Network of Associated Entities



NRE	Network of Related Entities
NoE	Network of Excellence project
PWRI	Public Works Research Institute
RE	Related Entities
RI	Research Infrastructure
SIMBA	A FP6 Project on Strengthening road transport research cooperation between Europe and emerging international markets
SIMBA II	A FP7 Project on Strengthening road transport research cooperation between Europe and emerging international markets
SRA	Strategic Research Agenda
STADIUM	A FP7 Project on smart Transport Applications Designed for large events with Impacts on Urban Mobility
TRA	Transportation Research Arena
TRB	Transportation Research Board
TRIPS	Trade Related Aspects of Intellectual Property Rights
VIAJEO	FP7 Project on Open Platform for Transport Planning and Travel Information
WATERBORNE	European Technology Platform for stakeholder from the Waterborne sector
WTO	World Trade Organisation

1 INTRODUCTION

1.1 Alignment of Stakeholders and methodology

The EUTRAIN project consortium consists of a small number of key partners and a larger number of third parties associated to some of these partners. In total the EUTRAIN consortium consists of a most representative set of stakeholders in transport research in Europe, ranging from academic institutes, membership associations, to commercial enterprises. Each of the consortium members has had substantial experiences on international cooperation work and has built an extensive network with key stakeholders worldwide. The EUTRAIN consortium had defined – right from its start – also a so called Network of 11 Associated entities (NAE), being themselves major international Transport research Organisations, while by using these members' own networks, the project further engaged a wider circle of stakeholders worldwide, ranging from government bodies (e.g. ministries of research and transport), to important research institutes and universities, industry etc. This was our so called Network of “Related” Entities (NRE).

In effect, the stakeholders involved with project EUTRAIN, in one way or another, covered a rather large and representative sample of relevant entities, which have been actively involved with international cooperation activities, primarily in the transport field but also in other research fields as well, either through participating in joint research projects, or administering research exchange programmes, or organising Conference / network events, etc.

The framework presented by EUTRAIN in this document has been developed by putting together the results of extensive and intense workshops, surveys and interviews as well as reviews of current activities on international cooperation, involving hundreds of individuals and organisations. During the two years of its duration, the EUTRAIN consortium organised four “regional workshops” in Athens, Beijing, Sao Paulo and Moscow with participants from their wider regions i.e.: the Mediterranean, Australasian, South America, and CIS/Black sea regions countries respectively. Each of these four regional workshops provided excellent opportunities to bring together European and international research experts in the transport field (but also, in some cases, wider disciplines), who discussed current practices, challenges, interests and the way forward. Participants of these workshops included not only researchers from academic organisations and industry but also policy makers from government and funding bodies. The results and recommendations in a

regional sense, coming (primarily) from these workshops, were reported in Deliverable D3.1 (EUTRAIN 2013).

Furthermore, the EUTRAIN consortium members also visited several individual countries such as China, Japan, U.S.A., Egypt, Algeria, etc. During these visits, the consortium members carried out comprehensive surveys through questionnaires, interviews and focus groups meetings. These surveys collected local stakeholders' needs and interests, priorities, as well as assessments of current international cooperative projects' practices and policies.

All the material that resulted from these activities and as the consortium's own research and experiences has been the main background to form the recommendations presented in this document.

1.2 Making International Cooperation a Major Contributor to European Transport Research

The transport industry is a major contributor to the European economy, with more than 12 million of European families depending on the sector. Its competitiveness in the global economy must therefore be an explicit objective for European transport research, in order to preserve and gain leadership positions. The European transport industry heavily relies on exports to emerging market countries, such as China, Brazil, India, Russia etc.

Although critical matters for the global competitiveness of the transport industry are firstly its ability in the development of future technologies, to become "leader" also requires knowledge on global trends, leadership of research and development (R&D) and knowledge of international market needs in different regions. International activities to collect information on global R&D trends and market needs, in order to strengthen European competitiveness are therefore essential. Moreover, since technologies and markets develop and move fast, efficiency of using information from international cooperation into EU's research programmes is a fundamental matter. The competitiveness challenge will remain high in the next several years, considering that other countries and regions have same objectives and actions to increase their own competitiveness.

1.3 Challenges faced

International research collaboration has to deal with specific issues and is faced with difficulties such as cultural differences, language barriers, different

project management and funding regimes as well as instruments, etc. In FP7 and FP6 projects dealing with international cooperation issues, it was shown that participation of international partners as consortium members is – in most cases - quite essential to the success of the project or research being performed. However, many organisations involved in international cooperative research work have difficulties to fulfil the necessary administrative requirements and are in several instances unable to efficiently use the available resources.

International cooperation activities also face resource challenges in Europe, too. Since some European countries are still in recession or on slow recovery, the importance of supporting international cooperation work may not be highlighted by policy makers and supported by the public. In other words, in some countries there may be growing a sentiment arguing in favour of research funding and sponsoring research in Europe rather than internationally. Moreover, the industry - particularly SMEs - may not recognise the benefits of international cooperation and therefore, may not be so keen to join and contribute to international cooperation activities.

1.4 Using the lessons from the past

The EU has already launched many initiatives and projects related to the international cooperation actions and programmes for research, either under the 7th Framework Programme in recent years or under frameworks of bilateral agreements for scientific and technological cooperation between EU and other countries/regions. The EUTRAIN project builds upon the existing experience and know-how in this field that has been gained in recent years through specific actions of international cooperation as well as projects / studies and goes one step further to make specific recommendations and policies that will be ripe for implementation.

Previous projects and previous work that were used in the report include:

- Previous and current EU-funded International Cooperation (INCO) projects such as for example CETRRA, DETRA, SIMBA, SIMBA II, VIAJEO, STADIUM, SOLUTIONS and Viajeo PLUS. These projects have been analysed, compared, assessed and linked together experiences and best practices for more productive international transport research cooperation.
- Multi-stakeholder initiatives representing all sectors of the transport industry such as the ERTRAC, ERRAC and WATERBORNE Technology

Platforms which serve as advisory bodies to the European Commission on the implementation of the Strategic Research agendas.

- Experience from independent bilateral or multilateral initiatives of international cooperation (most notably the recent ECTRI – TRB MoU and the work of its Working Group 10 on EU-US transport research collaboration that resulted from it, or the FEHRL – FHWA MoU and other similar initiatives).
- Experience and practices followed by other world transport research leaders, such as the U.S. TRB, the Japanese PWRI, the Australian ARRB, the South African or the Indian CSIR, and others.

1.5 Objectives of this Deliverable

This document aims at producing a comprehensive set of recommendations for putting in place an efficient framework for international cooperation in the transport research field (and in many aspects for any research field). Such framework¹ in adhering to the principles and orientations laid down in the EC Communication “*A strategic European Framework for International Science and Technology Cooperation*” [EC 2008] is primarily addressing the specific issues or “Themes” that have been found as of primary importance and relevance to international cooperation in the future, namely:

- Themes and Topics of priority interest to the various regions, for international cooperation work (vis-a-vis the EU);
- Programming and governance issues in target regions, including joint programming experiences;
- Research infrastructures and their networking possibilities;
- Information and data sharing issues;
- Research training and human resource issues including mobility of researchers and networking;
- Institutional cultures and research governance regimes;
- Pre-standardization activities and interoperability (of research results) – Harmonizing approaches and practices for the take up of research results ; and lastly
- Intellectual Property regimes and follow-up actions (after research results are produced).

¹ All modes of Transport are considered except aeronautics transport research

These recommendations are aimed to assist the EC in forming future programmes of international projects especially within the Horizon 2020 research programme.

2 METHODOLOGY AND MECHANISMS OF SETTING PRIORITIES AND TOPICS FOR FUTURE INTERNATIONAL COOPERATION PROJECTS

2.1 The EUTRAIN experience and suggestions based on current practices

Setting priorities and topics for future international cooperation projects and programmes has primarily been based on the priorities, the needs and the interests of the “funding” side i.e. the European Commission, or the US, or other European or third country governments. The receiving sides have to accept these priorities and perhaps adapt them to their own, if this is at all possible. Interviews and surveys carried out by the EUTRAIN consortium indicated that the cooperation partner countries should be more involved in setting priorities and topics of interest.

In the FP7 period, a notable effort has been made on the part of the EU to collect and assess needs and priorities of the recipient countries or regions either through projects, normally Coordination and Support Actions (CSA) projects, or multi-stakeholder initiatives or specially convened expert groups. For example, CSA type of projects such as the EUTRAIN project, have also been tasked with the definition of topics of interest and priorities in countries with which the EU’s FP7 programme funded international cooperative research activities. To mention the most recent ones: project SIMBA, SIMBA II, Viajeo PLUS and SOLUTIONS have had specific tasks to identify priorities and topics for future international cooperation for different regions. Some of these projects had international partners such as in SIMBA and SIMBA II, so that they could finance their direct participation in these activities. Other projects without international partners allocate travel expenses and / or subcontracting, to allow international participants to join project meetings or events and contribute to the project outcomes. Often, these CSA projects also have objectives of building contacts in targeted countries, thus using the contacts to identify local needs. By analysing the local needs with European stakeholders’ interests, mutual interests can be identified. Following the identified priorities from those Coordination and Support Actions projects, the EC may publish specific calls for international cooperation projects or other activities.

It has been identified that a more permanent mechanism has to be established, through which the relevant Commission services will be able to monitor the general trends, needs and priorities for transport research funding in specific target regions and / or countries. This mechanism could take the form of an Observatory that would take input from specific sources carefully selected so as to be:

- ✓ Representative;
- ✓ Reliable;
- ✓ Knowledge and experiences

The technical form of the Observatory may be a type of internet based platform. The stakeholders to be involved in the Observatory, administration and funding can be defined through a specific CSA project. Through the project, the Observatory may be defined, planned, set up and initially work for a few months (or years) before it is handed over to its permanent hosting organisation, which will be one of the Commissions's DGs or connected Agencies.

The existing multi-stakeholder initiatives or expert groups, such as the ERTRAC, should continue to play their roles in providing recommendations on research topics, research priorities, as well as roadmaps and implementation plans. Few of such initiatives or expert groups, however, have been involved in setting priority of international cooperation.

Another alternative (non-exclusive from the others) is existing transport research Associations representing the research providers. Some of them are partners of the EUTRAIN project. These Associations, through their own initiatives, have already formed in the past organisational mechanisms that could be suitable and used for this purpose, as media for reaching out to international cooperation countries and preparing the ground for a more successful and efficient topic definition, or Terms of Reference preparation for future EU-funded international cooperative work. It is noted that many of these organisational mechanisms were initially formed from specific project consortia. For example, the FP7 project *DETRA (Developing the European Transport Research Alliance)* later formed a partnership named *ETRA (European Transport Research Alliance)*, whose prime objective is the support the materialisation of the ERA-T², but which could also form a medium for supporting the Commission in its international cooperative work.

² The European Research Area in the Field of Transport.

Such mechanisms and initiatives or platforms can form the basic mechanism for topic definition and prioritisation of international cooperative work within H2020 together with the other suggestions made in later sections.

2.2 Suggestions from other projects: The SIMBA and Viajeo / STADIUM experience

FP7 projects SIMBA and SIMBA II are two Coordination and Support Actions projects for international cooperation covering the BRICS countries, i.e. Brazil, Russia, India, China and South Africa. The projects had several tasks including the establishment of local contacts in targeted countries and the identification of research priorities and common interests. Their recommendations included topics of priority interest as well as mechanisms and a roadmap for promoting international cooperation. As regards specific topics, two priorities were defined:

- Traffic data integration and travel information;
- Use of ITS for large events (e.g. sports events).

The EC later published an FP7 call, which included the above two topics for *Specific International Cooperation Actions (SICA)* and two projects were funded following this call:

- Viajeo (International Demonstration of Platform for Transport Planning and Travel information), and
- STADIUM (ITS for Large Events).

The project consortia of the Viajeo and STADIUM projects were formed through dissemination and network events of the SIMBA/ SIMBA II projects. As regards the suggested mechanism, this consisted of the following five steps (SIMBA and SIMBA II projects covered the three first steps). The steps identified are shown in the following Figure 1.



Figure 1: The five main steps in International Cooperation work

It is of interest here to mention the two realisations of the above projects that are of direct relevance to our recommendations, and are lessons learned from this work:



- a. Slow implementation of ideas, resulting in inefficient use of outcomes of identified priorities. For example, the SIMBA project delivered reports on identified research priorities and topics in 2006 - 2008. The programme of the SICA (*Specific International Cooperation Actions*) was published in 2008, and the first R&D project was launched in 2009. When the first R&D project was launched, some of the priorities that were mentioned in the original projects were already mature and in the market and no longer of priority interest to European and international partners.
- b. Lack of a mechanism to regularly update identified priorities. The SIMBA II project was completed in 2010. Outcomes of SIMBA II have been used by the EC even after the project's life cycle but in general updating and maintaining the outcomes of research projects (in this case Coordination and Support Actions) after their life cycles is a challenge.

2.3 Recommended funding mechanisms and practices

Having commented and suggested on the need for setting up a permanent mechanism – observatory for monitoring the needs and priorities of the various recipient regions and / or countries on a permanent basis, it is now important to also comment on the suggested funding mechanisms that should be applied. It has been proved during the FP7 international cooperation project experience that while using Coordination and Support Action types of projects is a rather successful practice, the funding schemes to be used could well be improved from FP7 practice, in order to optimise usage of recourses.

In the experience of this project's partners, a more suitable type of funding scheme that can be used more in the future is the one used for the 'Thematic Networks' *Competitiveness and Innovation Framework (CIP)*. Such funding scheme has:

- Fixed rates based on the duration of the project and number of partners; For example 300 Euro per year per beneficiary for the first 10 beneficiaries;
- Personnel cost acknowledged to the coordinator only, for reporting and organising meetings;
- Other partners only receive fixed Lump Sums for general expenses; and
- Only the coordinator is required to submit a financial report.

Such a practice can significantly reduce the administrative burden to the participants, thus enabling partners to focus on the real contents of a project rather than spend resources on administrative and financial reporting, which is often more difficult for international partners since different countries may have different financial management and accounting systems. Moreover, such projects may cover longer time periods, e.g. 5 years instead of 2 or 3 years of the current Coordination and Support Actions projects. For example, by reference to the recommended above research project to establish on a permanent basis an “Observatory” for international transport research coordination work (for monitoring the needs, topics, priorities, etc.), one could justify a longer time duration (e.g. 4-5 years), in order to allow for the necessary planning, developing and setting up, as well as running for a limited period of time, the “Observatory”. Such a project could be assigned with the task of building this “Observatory” in its totality (i.e. all modes, all global regions) or there could be 2 or 3 or even more projects assigned with specific parts, either per mode, or per geographic region.

The key word in the funding and administration function of international cooperation projects should be “simplicity”. This has been particularly underlined by researchers from even well advanced countries, who get increasingly discouraged from participating in EU funded research projects, either because of the sheer complexity of the rules or because of not getting in time all the required elements for participation. A project should not cover too wide range of topics or too wide range of regions. For example, if a project covers topics ranging from road, railway, air to waterborne transport and regions ranging from developed countries to emerging market countries, the project may not be able to deliver outcomes for all topics and all regions at the same quality. Outcomes for some topics and some regions may be at a superficial level.

3 RECOMMENDATIONS ON FUTURE JOINT PROGRAMS, FUNDING SCHEME AND PROJECT MANAGEMENT

3.1 The experience of joint programming and funding schemes in the EU

Joint programming is a term used to express a comprehensive form of international cooperation, in which two (bilateral joint programming) or more (multilateral) countries join their forces as regards funding and programming, in order to produce common research programmes and calls for proposals. Joint programming has so far been practiced within Europe between European member states or EU FP7 associated states, who have issued common calls for specific research programmes jointly funded by all countries involved.

This European Joint Programming process was launched by a Communication of the European Commission in July 2008 and was supported subsequently by a number of other documents clarifying and further defining the processes. The most well-known dedicated configuration for the European joint programming process was produced by the European Research Area and Innovation Committee (ERAC) and its High Level Group on Joint Programming (also known as GPC). Also the EU's Competitiveness Council adopted several conclusions since 2008 to guide the development, steer the process and identify the themes for possible JPIs as the specific programmes that were called.

Later on, in March 2010, when the EC launched its initiative Europe 2020 – A European strategy for smart, sustainable and inclusive growth the joint programming initiatives were further mentioned as primary “tools” towards completing the European Research Area (ERA), a common research space for the whole of Europe including joint research funding and programming between Member States and regions. The experience so far of European JPIs can therefore be used as a model for recommendations for wider international cooperation progress based on some form of International Joint Programming Initiatives (IJPIs).

The JPIs in Europe today follow a structured and strategic process, according to which EU Member States (and under conditions some of the FP7 associated countries) agree on common Strategic Research Agendas (SRA) to address major societal challenges. Main scope and objective of the JPIs are to gather national research resources and efforts, in order to make better use of Europe's public R&D resources and to address common European social challenges more effectively in a number of themes. "Urban Europe, future of cities and Transport – Sustainable Transport" is one of the themes.

The JPIs are at a voluntary base and do not require EU Member states in each specific initiative. The consortium partners involved must be resident in the countries that co-finance the specific initiative and must be able to provide and commit the required critical mass of resources, in order to execute the specific research programme. Each national participant can be funded up to a limit. Of special importance is the governing structure of European JPIs. There is an "individual" governing mechanism that is put in place within each JPI, but overall control and supervision of the whole process is provided by the Council of the GPC in ERAC, which identifies the specific areas in which the JPIs are to be launched and implemented, approves the SRA and generally supervises the process of setting up a new JPIs and performing research. This process goes through four basic stages:

- a. Developing a common vision for the JPI;
- b. Defining a SRA, specific objectives and related deadlines;
- c. Setting up the JPI and Implementing the SRA; and
- d. Monitoring the results so as to ensure the maximum impact.

The practice of JPIs so far has marked a change in European research cooperation, offering a voluntary process for a revitalized partnership between the Member States based on clear principles and transparent high-level governance. It has also been made apparent that the various European National governments (central or regional) have the competence over their choice of research and innovation policies and related allocation of resources.

3.2 Transferring the European experience to the international level

It has been known that the European JPIs are beneficial. Thus transferring the European JPI to international cooperation would be a potential mechanism to establish more efficient international research cooperation in transport

across the world. Principles to develop the future international JPIs are proposed below:

- Variable geometry of each JPI and open access, i.e. based on the needs and configurations of each particular country grouping and being open in the sense of allowing later entries or exits if conditions change and under certain procedures;
- Increasing the efficiency and effectiveness of the participating States' ability in dealing with large-scale socioeconomic challenges and problems;
- Voluntary in nature, i.e. participation based on the simple recognition of the practical usefulness of what is being proposed;
- "Supervision" by a trusted neutral Organization or network of Organisations, so that there exists some sort of "triggering" and monitoring mechanism;
- Streamlined and simple implementation, i.e. without unduly complex and lengthy management procedures at all levels;
- Short turnaround times from research proposals to research results. This is also necessary taking into account that an element of urgency is implicit in tackling the sort of challenges that international research cooperation is supposed to be good for;
- Managerial Flexibility, e.g. in allowing the possibility to choose, within a range of managerial reference models, the option considered most suitable in the specific case and circumstances;
- Uniform and objective evaluation procedures, applied to all levels and stages according to specifications and appropriate benchmarking principles;
- Openness to change and evolution, so as to maximize the benefits that could be derived from the experience to be gradually gained in running actual IJPIs; and
- Low administration overheads by all categories of actors involved in the Joint Programming process (research funders, research managers, scientists, industrial partners, etc.).

It would be difficult to set up a framework for international JPIs due to limited resources during periods of economic crisis. Therefore, such framework should first be considered for a relatively small number of countries around the world, in which common understanding and matching capability of funding for joint research initiatives already exist. It may start with a bilateral cooperation and then gradually move to multilateral schemas. The main problems and hindrances in starting this process (even at bilateral level) are mainly due to:

- a. Differences in research organisation and management models in the various countries around the world;
- b. Differences in funding regimes and procedures;

- c. Non-existence of appropriate supervising and monitoring Organisations;
- d. Insufficient recognition of common challenges and priorities; and
- e. Limited financial and human resources.

Proposed recommendations to address the above challenges are:

- A. Harmonisation of research organisation and management models, i.e. more harmonised research governance would be necessary before any cooperative effort such as an IJPI could be successfully launched. This could be brought about in two alternative ways: either a) by getting a well-recognised international Organisation like the OECD or the UN involved. The aim would be to create global standards for research governance and then work towards having countries adopt these "standards" through the adoption of some sort of international convention (in the case of the UN), or b) by promoting such standards through bilateral negotiations and promotion as part of bilateral scientific agreements. In both alternatives if the EU could get the support and cooperation of other "research developed" countries, e.g. the US, the chances of quick success would increase substantially.
- B. Funding: This is a more difficult area to handle and a more sensitive one because countries will not be willing to commit to specific guidelines that may have financial implications for them. Nevertheless, funding is one of the major stumbling blocks and some uniformity in the ways of decision making, planning and committing funds for International Joint Programming projects must be achieved. Our recommendations as to how to achieve this would be similar to the recommendations as in A above.
- C. "Neutral" supervising and monitoring Organisation: Finding a "neutral" Organisation that would - at an international level - monitor and provide guidelines for International Joint Programming initiatives, is a major difficulty. Such "neutral" organisation would play the role of the CPC in ERAC as operating within the EU's JPI practice. It is felt that at international level such "neutral Organisation" can be found in the frame of one of the United Nations Institutes or specialised Agencies (e.g. UNESCO, or UNDP, or even UN "Institutes" such as the Institute for Training and Research - UNITAR or other appropriate UN agency). Alternatively, some well-developed regional or international NGOs should also be considered.
- D. This is an area in which this present project EUTRAIN has made a start and through whose work it seems quite feasible to establish common priorities at regional level. We have also recommended establishment of a common permanent mechanism for monitoring trends in the research needs and in defining common challenges and priorities.

- E. This is meant to refer mainly to the existence of human resources capable of handling the complex managerial and scientific tasks that will be necessary, in order to have “balanced” participation in the JPIs i.e. projects with teams that represent a “balanced” involvement of all sides in the initiative. Of course, the funding provided by each participating country (which would constitute the “common pot” money to be used for funding of the research projects in a specific JPI) should also be “balanced”. However, the word “balanced” herein means “relevant to each participating country’s GDP or some other measure of economic strength and capability”. The guidelines that should be worked out as suggested in (A) and (B) above, should clarify this issue too.

3.3 International research governing and project management issues

In the experience of this project’s partners, especially with emerging economies such as Brazil, Russia, India and China, who have been active in participating in international research and development projects funded by the EC in the FP6 and FP7, simplicity and ease of application of the various research governing and project management procedures is absolutely essential. The types of projects with the highest participation of international partners in the past are mainly demonstration and networking projects (CSAs). These types of projects have been very successful in introducing new concepts, technologies and European standards into these countries and also building extensive networks with local research organisations, government bodies and the industry. In the future, however, the fast economic growth in these countries, which leads to significant increases in R&D funding, will most likely make the relatively low funding coming from the EC for its international cooperation programmes not as attractive as before, particularly for large and “well known” research organisations. Also, researchers in certain emerging countries (especially in China) have made it quite clear that they would prefer real R&D types of projects rather than the Networking / dissemination types, as was mainly the case in the past.

Research governing and project management structures must be simplified as much as possible, especially when dealing with international cooperation projects. A more simplified type of project funding should also be evaluated and adopted for international cooperation projects. As we recommend in chapter 2, the Commission should consider for adoption the type of project funding closer to the one used in the Competitiveness and Innovation Framework (CIP) projects. Such funding scheme may have features like:

- Fixed rates based on the time length of the project and number of partners;
- Personnel cost acknowledged to the coordinator only, for reporting and for organising meetings;
- Other partners only receive fixed Lump Sums for general expenses;
- Only the coordinator is required to submit a financial report.

The aim is to significantly reduce the administrative burden to the participants, thus enabling partners to focus on the real contents of a project rather than spend resources on administrative and financial reporting which is often more difficult for international partners since different countries may have different financial management and accounting systems. There are a number of other relevant issues that need to be considered which surfaced at our various workshops and Conferences and these are mentioned in summary form in the following:

- a. In some of the “emerging economy countries” primarily in China and Brazil, researchers are more interested in bilateral cooperation rather than multilateral cooperation (i.e. Brazil-EU or China-EU rather than having a project involving EU, Brazil and China).
- b. Different project management frameworks that are applicable and more suited to the local management practices maybe necessary to be allowed for partners in different countries/regions. However, since such a varied “landscape” of management may result in insufficient cooperation among partners, it is not recommended here but what is recommended, is that the management framework applied in a particular international cooperation programme does take into account the cultural and organisational specificities that exist in different countries/regions.
- c. Preference for leaner (smaller) consortia e.g. with less than 10 partners should be preferred for international cooperative projects.
- d. Finally, preference for solid R&D rather than CSA types of projects has clearly be shown in certain major emerging economy countries, such as China.

3.4 A first step towards a proposal for International joint programming

Given the difficulties and uncertainties inherent in an international multilateral joint programming initiative, we would suggest that a first step with good opportunities for success would be to try and establish such an International JPI with 2 or 3 other countries that already share with the EU common principles and research ethics. Such first potential partners, to be explored,

could be found - in our experience – from countries such as: the US, Australia, Japan, South Africa, India, Canada, and Russia. These countries could adapt more easily to the needs and boundaries of an IJPI as described above and commit the necessary resources for the funding. Establishing some commonly agreed and accepted rules would be the first step in the establishment of such IJPIs. Once a first IJPI is set up and running, others will certainly follow and the common rules will be further refined and adopted to the region or group of countries being considered. Starting with the transport sector we would recommend the following alternative topics as potentially interesting areas that could draw enough interest for such first IJPI:

- A. Sustainability of surface transport in urban areas (dealing with all issues of congestion, pollution, clean cars, and environmental traffic management);
- B. Maritime transport with emphasis on anti-pollution and safety and security issues;
- C. Climate change, transport related adaptation and mitigation measures.

For the potential Joint Programming Initiative, there is a need for an effective and multi-channel communication (including social media capabilities) among the research communities internationally for quick and timely transfer of information regarding calls and deadlines, etc.

Potential obstacles that will have to be overcome (even in the case of these select countries) are:

- Setting the framework conditions (most important issue – should be based on the 10 principles mentioned earlier);
- Aligning with (rather strong in these cases) national priorities;
- Achieving inter-agency coordination within each country;
- Ownership of outcomes and uncertainty of impacts;
- IPR and industrial “take-up” rules for the results;
- Engagement of the private sector.

It is expected that setting up such a framework and defining all necessary boundary as well as benchmarking conditions for such an IJPI, would require a separate investigation which could well be funded through a short term (e.g. 18 month) project within the new H2020 framework.

4 GLOBAL RESEARCH INFRASTRUCTURE – INFORMATION AND DATA SHARING

4.1 Introduction

There is no doubt that world-class Research Infrastructures (RIs) are engines of innovation and therefore form the backbone of socio-economic development. Vierkorn-Rudolph stated in ESFRI (2010) that:

"Especially in difficult economic circumstances, research and innovation are the key drivers for welfare. Excellent Research Infrastructures enable the cross disciplinary, frontier research and innovation that is needed to address the Grand Challenges.

Research Infrastructures also play a crucial role in the training of young scientists and engineers: they attract thousands of scientists and students from universities, research institutions and industry. They guarantee the generation of new ideas and developments which turn into innovations and therefore support the creation of jobs."

The transport sector is no exception to this general rule and indeed their harmonised and collective use can be a fundamental "tool" and "ingredient" of the international cooperation framework of the future in the field of Transport. In view of future challenges, which include climate change, globalisation, demographic changes, more efficient movement of people and goods and scarcity of resources, and in conjunction with the financial constraints countries are facing due to the economic crisis, there is a growing need for new, world-class RI to address these and other challenges and at the same time increased pressure for a more open use and utilisation of the existing ones. At the same time, there is also an aspiration for instilling greater international collaboration in research, development and implementation (RDI), especially to create critical mass to address the challenges and to realise economies of scale. To a certain extent this aspiration is being driven by economic constraints; while the challenges remain the same, maintaining up-to-date research facilities and qualified personnel to address common transport related problems and challenges is becoming increasingly more difficult to manage by individual countries and organisations, and hence

there is a need for greater international collaboration to overcome these hurdles and achieve collective impact.

Since most countries are facing the same challenges, it has become important to develop a framework and a roadmap that provide guidance on the development and establishment of international networks and the setting up of collaborative agreements that will enable researchers to cooperate and to share not only their knowledge and data but also each other's equipment and facilities in order to build the critical mass and generate the economies of scale and collective impact referred to above. Both the framework and the roadmap need to provide for the establishment of new, world-class RIs through multinational collaborative agreements.

Several examples have shown that networking, cooperation and especially collaboration do achieve the desired results, but there is still a need to raise greater awareness at an international level. International collaboration will face obstacles and barriers, but existing examples have shown that these can be resolved.

The main objectives of this chapter are firstly to identify models and tools to raise awareness on international cooperation and collaboration around RI in the transport sector for improving networking, and secondly, to describe the common needs, to identify forums to deliberate these needs and to create global research alliances and international working groups to stimulate greater international collaboration to address the needs. This chapter builds on previous work undertaken in Transport Research Equipment in Europe (TREE³), TRANSFORUM, ALT-COST, DETRA⁴ and other projects.

³ The TREE project, financed by the EC as part of the Sustainable Growth programme, was carried out between 2002 and 2004. The main target was to create meaningful and cost-intensive research installations and equipment in Europe and to improve the exchange of information 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).

⁴ The DETRA project was financed under FP7 by the EC and was carried out between 2010 and 2012. The aim was to provide a detailed examination of the current status and structure of transport research and to create a comprehensive assessment of all aspects pertaining to the ERA development. It was intended to support the development of the Surface Transport ERA.

4.2 Necessity for international cooperation and collaboration on Research Infrastructure

RI not only stimulates innovation, but it is also a tool that supports the creation of a research environment where researchers can meet and exchange knowledge and experience, and generate new ideas (DETRA, 2010). Through RI, a pool of excellence is created; young and experienced researchers from similar/different disciplines can come together to develop solutions that can be implemented almost immediately, as well as innovative, solution-oriented ideas that could be implemented in the future.

There are several drivers for increasing international cooperation around existing RI. One of the key drivers, especially exacerbated by the global economic crisis, is finance. In recent years, many owners of RIs have had to defer the maintenance of their RIs and especially their plans for upgrading the RIs, due to cuts in research funding. Hence, the development of new, high-level and resource-intensive RI unilaterally is becoming difficult, particularly since, from the perspective of RI owners, the RI has to finance itself from the proceeds of research projects. The possibility of sharing costs bi- or multilaterally for the establishment of new, critical and large-scale RI would therefore become a viable option, if not the only option for the establishment of such RI.

Enabling international organisations to share facilities will give organisations/countries access to facilities that these organisations/countries would otherwise not have been able to own themselves. Appropriate outcomes from RDI activities could be implemented directly in the countries of the participating organisations.

Another benefit of cooperation between international organisations with similar facilities is the ability to exchange and/or to increase the knowledge of people working in these facilities. Such cooperation may lead to the development of new test methods and also contribute to the standardisation and harmonisation of test methods and procedures.

Through cooperation between international organisations with complementary facilities, resources could be deployed optimally. This may be benefitting the research community by the creation of a diverse pool of experts capable of stimulating innovation.

Ultimately, there is a need to address the global challenges through global research, which implies the need for RI. Since it is not feasible to duplicate

high-level RI in all countries and to resource each facility with the required technical personnel this leads to the idea of knowledge sharing and sharing of RIs in order to achieve a common goal. At this point, collaboration and tools that facilitate collaboration are indispensable.

There is an urgent need for the creation of additional new world-class RI to address common future challenges. In the transport sector, research thus far has mostly been conducted in a fairly fragmented way, in line with available budgets, and usually with limited impact outside the country where the research was undertaken. In order to find sustainable solutions for the global challenges, there is a need to pool international expertise and invest in the required world-class RI to support RDI activities through collaborative agreements. Global access and interoperability will add value to money spent. The global challenges can only be resolved by focused and dedicated action of the best researchers in the world, complemented by the required RI, in order to achieve collective impact.

4.3 Research Infrastructures and their networking

4.3.1 General

This section summarises the results of the research infrastructure part of the previous reports of the project dealing with current practices and issues in international transport research cooperation on which the following roadmap and recommendations for the realisation of international cooperation on RI are based.

For the collection of this information, the country reports and the reports from regional seminars as well as information collected by directly contacting country champions were evaluated. Information from the following countries was summarised: Australia, China, Egypt, India, Japan, Russia, South Africa, Tunisia, Turkey, Ukraine and USA. It is important to point out that interest for international cooperation was stated even though the main form of “cooperation” thus far had been the sharing of knowledge through seminars and conferences. Good examples of existing international cooperation around RI were very limited. Hence, the recommendations are based on the few existing positive examples that were identified.

The final recommendations therefore adopt a more general approach. Nevertheless, the identified main drivers for international cooperation around

RI point towards a tendency for greater cooperation and collaboration in the future. The main drivers are:

- **The Grand Challenges** – the need for large-scale unique RIs that can be used as a hub-facility to solve common transport related problems and challenges collaboratively;
- **Finance** – sharing the financial risk;
- **High quality RIs** – a basic requirement for performing high-level research, but it is unaffordable to duplicate similar RIs in every country;
- **Innovation and development** – new ideas and new knowledge will be the result of improved networking and cooperation around RIs;
- **Scientific excellence** – the best researchers will be attracted to world-class RI;
- **Next generation researchers** – the possibility to work in association with high-quality RI will attract the next generation of researchers.

Obstacles from the point of view of the contacted countries can be divided into the following subgroups:

- National legislation;
- Financial constraints;
- Cultural differences, and
- Specific issues related to the RI itself, e.g. additional costs if ICT issues and data-sharing issues cannot be resolved.

The fact that some countries do not yet perceive the benefits of cooperation around RI might suggest that the advantages of international cooperation, including their main drivers, have not yet been promoted adequately and have not been emphasised sufficiently, as reflected by the limited experience in international cooperation around RI. Hence, for these countries, it may be necessary to go back one step, and to start with the promotion of international cooperation before addressing the development of tools and models to resolve obstacles and barriers so that fruitful international cooperation, and ultimately collaboration, around RI can be facilitated.

4.3.2 Findings from current examples on shared RI

4.3.2.1 Projects involving RI

Examples of successful cooperation between laboratories were identified during the execution of EUTRAIN project's Task 2.5 and are described in EUTRAIN Deliverable D2.1 (2012). These include:

- ATLANTIC project – thematic network of professionals, researchers and decision-makers from Europe, the USA, and Canada in the field of Intelligent Transport Systems;
- Driving under the influence of drugs (DRUID) project – measurement vehicle for driving tests;
- PIARC – experiment on skidding resistance;
- Harmonisation of European Routine and research Measuring Equipment for Skid Resistance (HERMES) – harmonisation and standardisation;
- COST 347 – development of a common code of practice for optimising the use of Accelerated Load Testing facilities in Europe, resulting in the formation of TRB's AFD40 Committee;
- TRID – development of a collaborative database, integrating the Transportation Research Board's *Transport Research Information Services* (TRIS) and the International Transport Forum's *International Transport Research Documentation* (ITRD) databases.

The evaluation of these projects resulted in the following general findings of importance to the fostering of international cooperation and collaboration in the field of RI:

- By cooperating on RI, a climate can be created to facilitate the development and adoption of more harmonised approaches, which would contribute to the acceleration of research on specific themes, followed by practical improvements.
- Often an initial project will lead to subsequent activities (working groups, research cooperation) around the same RI.
- Each successful cooperation effort helps to create or to further develop networks around special research fields.
- Having a common purpose and reason to collaborate is key. Allocation of funding to contribute to the cost of participation could form an incentive. It should be taken into account that funding for the initiator and the partners should cover the same time period. By initiating this first step, countries that have constraints impacting on effective collaboration may be convinced by the positive results of the project.
- Collaborative work needs to be targeted and structured to provide a benefit to all participants.
- Collaboration on RI can bring together different capabilities and competences of the partners, e.g. technical experience and technical equipment. It also enables critical mass to be created that is likely to be more efficient and effective in addressing the research problems and challenges, which in turn supports the further development of a research field.

- In some cases it may be possible to overcome legal barriers existing in one country by transferring RI to another country, still being able to build on the existing experience by running the facility by experienced experts or with their support.
- Shared databases are essential to create a network of knowledge. Their benefits include the promotion and marketing of organisations, research projects and research outputs and outcomes. In addition, they offer the opportunity to identify and promote RIs with the potential to be used collaboratively and thus create a marketplace for both providers and researchers.

4.3.2.2 Existing networks

The following examples of networking around RI were investigated (a comprehensive description of the networks can be found in EUTRAIN Deliverable D2.1):

- Driving Simulators – sharing knowledge and experiences;
- International Benefits, Evaluation and Costs (IBEC) – an example of an ongoing network;
- Heavy Vehicle Simulator International Alliance (HVSIA) – cooperation in order to improve operational efficiency and to promote data and information sharing between members involved in Accelerated Pavement Testing programmes.

Outcomes from discussions held on the issue of networking suggested that the networks could benefit from:

- Establishing a structure for ongoing interactions on topics related to the field of study of the network;
- Sharing results and analysis methodologies;
- Sharing information about operational issues (e.g. on test devices and data capturing instrumentation);
- Establishing mechanisms for funding, monitoring and completion of studies on common issues through optimum participation by members of the network;
- Discussing and documenting research practices and improvements thereon, and the implementation of results;
- Identification of novel technologies;
- Identification of hardware and software improvements/requirements, and
- Holding regular meetings to address specific issues benefitting the members of the network and associated partners resulting in improvements for RIs in this special research field.

4.3.2.3 RI shared between different partners or countries

Good examples of RIs that have been shared between different partners or organisations include:

- Heavy vehicle simulator – sharing RI between countries;
- Minnesota Road Research Project (MnRoad); full-scale accelerated pavement testing facility – using a facility as a hub to benefit other states/countries;
- Multi-Axial Sub-assembly Testing (MAST) laboratory – a shared-use research facility.

The following main findings have been recognised:

- Cooperation between countries can be achieved by sharing expensive, high-level RI which otherwise would not have been affordable for a single country, by sharing risks and costs.
- It is necessary to be aware of cultural and other differences between countries and to handle these differences in a smooth way in order to overcome barriers.
- Open access and wide use of data collected at a facility offers an opportunity for international researchers to get out the most of the research conducted there. This feature would attract researchers of high international reputation.
- The development of harmonised standards can be advanced through improved cooperation.
- High-level RI catalyses cooperation and, if striving for a common goal, collaboration across borders.

4.4 Findings from initial responses and regional workshops

Information obtained from ten countries on their experiences with RI and the reports of three regional workshops conducted in the EUTRAIN project were analysed and used as input in Task 4.2. The aim was not only to identify topics of interest for future cooperation between countries using world-class RI, but also to identify possible barriers and obstacles to collaboration in order to find solutions and to give recommendations on how to overcome these problems.

Topics of interest

For all countries, the topics of interest seem to be aligned with the Grand Challenges, i.e. climate change, ageing population, efficient transport systems vs. congestion, and sustainable transport. Since these challenges are

all global, the countries expressed interest in collaboration in order to find sustainable solutions.

World-class RI

There are a number of RIs that can be classified as world-class. However, it is necessary to raise awareness of their existence with the international research community in order to stimulate collaboration.

Examples of cooperation including RI

Despite the limited number of international cooperative initiatives around RI, there are examples of initiatives that have worked very well. These examples show very clearly that hurdles can be overcome if there is real interest for cooperation. All projects have shown the great benefits of international cooperation and have yielded excellent results.

Obstacles and barriers

The questionnaires received from countries contacted bilaterally and the country reports indicated a number of obstacles and barriers. They can be divided into the following three groups:

1. Barriers caused by national legislation

- In some countries, large research facilities are owned by public sector entities, who usually do not insure their assets. As a consequence, it may be required that national staff operates or at least assists with the operation of the facility.
- Due to limiting conditions imposed by certain countries, it may often be difficult to transfer data and outputs of RDI projects to other countries. This then implies that the implementation of RDI results outside the country of origin may also be difficult.
- Some countries, through legislation, may impose restrictions on information sharing.

2. Barriers caused by financial issues

- Concern was expressed that international cooperation could increase costs (e.g. travelling and accommodation costs of researchers).
- The transfer of funding between different partners may be difficult.
- Some researchers responded by indicating high interest for international cooperation and for making use of RI outside of their mother country, particularly in cases where, due to financial constraints, the condition of their RI had deteriorated to such an extent that the RI was no longer meeting world-class standards. On the other hand, countries possessing unique and up-to-standard RI and having

sustainable research funding cited to benefit from having highly motivated researchers.

3. Barriers caused by cultural differences

- While in Europe it is understood that most high-level researchers are able to communicate in the English language, there are some countries where language could restrict or even prevent cooperation.
- It was mentioned that, because of limited round-robin testing or opportunities for comparative testing between similar types of RI, it is not always possible to assess the level of quality of national RI and to benchmark them against international RI.

In addition, it was difficult for some countries to perceive the benefits and drivers for cooperation around RI. One of the reasons for this could be their limited experience.

4.5 Proposed models and tools for future international cooperation and collaboration involving RI

4.5.1 General

Based on existing examples of successful sharing of RI (Section **Erreur ! Source du renvoi introuvable.**) and direct interviews held with researchers (Section **Erreur ! Source du renvoi introuvable.**), it can be concluded that there is both a strong need and willingness to conduct international research projects jointly from the perspective of international research organisations. The preferred RDI topics all seem to be aligned with the Grand Challenges, suggesting similar research interests at international level. This basic interest and willingness to cooperate should be nurtured, accelerated and channelled by appropriate support actions. Without this support, international cooperation will strongly depend on individual willingness and chance. There are several instruments that could be used to accelerate international cooperation on RI.

Cooperation starts with a need and the awareness of the RI capabilities. This implies that the benefits of common or shared use of RIs should be well-known, and that instruments for the identification and promotion of RI capabilities should be readily available. Platforms representing the interests of international organisations involved in transport research should be used to promote the necessity for and the benefits of international cooperation on RI.

As a next step, it is important to promote and present this need at international conferences such as Transportation Research Arena (TRA) and Transportation Research Board (TRB). By doing this, the relevant stakeholders in the international research community can be brought on-board [ETRA 2013].

Meetings between parties involved in European and international research projects, including COST meetings, as well as bi- and multi- lateral meetings between research organisations provide a perfect framework for presenting the capabilities of dedicated RIs and for addressing specific problems. It is recommended that information sharing of RIs becomes a standard agenda item at such meetings.

Support on a political level, especially within the EU, is necessary to increase collaboration on a scientific level to achieve collective impact. In addition to European funding for research projects to foster collaboration on existing RIs, it is of utmost importance that large, critically important transport RIs associated with the transport sector be included in the future roadmap of the European Strategy Forum on Research Infrastructures (ESFRI); currently, transport-related RIs are not included in the ESFRI roadmap. In parallel, this process should be accompanied by the identification of interested organisations to sign collaborative agreements for the joint use of these transport related RIs.

4.5.2 Roadmap for international collaboration on RI

There is general agreement on the main topics of interest in all countries that have been contacted: climate change, ageing population, more efficient transport systems (e.g. minimising congestion), and sustainable transport. These topics are aligned with the Grand Challenges which are global. This implies that there is convergence of international interests and priorities.

The findings from current examples on shared RI (Section **Erreur ! Source du renvoi introuvable.**) and the feedback received from organisations and researchers that were interviewed (Section **Erreur ! Source du renvoi introuvable.**) all point towards a roadmap comprising five levels:

1. Explanation of need and benefits of cooperation (**NECESSITY**)
2. Sourcing of partners through database searches (**AWARENESS**)
3. Establishing networks around special research topics (**CONSOLIDATION**)
4. Sharing knowledge and experience (**KNOWLEDGE SHARING**)
5. Linking through common RIs (**FORMAL COLLABORATION**)



Figure 2 Levels of networking around RIs

Based on the findings of EUTRAIN, the roadmap, originally developed in the DETRA project, has been refined and substantiated as outlined below.

Level 1: Explanation of need and benefits of cooperation around RIs (NECESSITY)

The very first step towards establishing cooperation around RIs is to explain the needs for and benefits of cooperation. This may sound simple, but before organisations are able to identify the potential for cooperation around RIs (Level 2: AWARENESS), they have to be convinced of the necessity. In order to overcome the existing obstacles and barriers, which include

- limited experience in networking and cooperation;
- cultural differences;
- missing common reasons for cooperation;
- different levels of excellence of RIs, and
- language difficulties,

the following actions should be taken:

- Increase experience by participation in international projects and networks of excellence, and/or become members of umbrella organisations;
- Allocate funding to contribute to the cost of participation;
- Raise interest by presenting positive examples and highlight their benefits.

The experience gained through these actions will form the basis for possible future cooperation around RIs.

Level 2: Sourcing of partners through database searches (AWARENESS)

Level 2 is aimed at creating awareness of the existence of world-class RIs in the international research community in order to foster possible cooperation. A possible way of raising awareness is through the development of an RI database containing world-class RI addressing all transport modes, e.g. by further developing the FEHRL RI Online Catalogue, and rendering this database accessible to the research community.

This tool should be able to provide the following information and support the following actions:

- A. An up-to-date database of existing international world-class RI of all transport modes;
- B. The identification of missing RIs to address current and future needs;
- C. The identification of opportunities for cooperation between researchers and/or organisations, which could include: knowledge and information exchanges; optimisation of RI usage; development or acquisition of shared RI research facilities; and, improvements of existing test methods and equipment;
- D. The identification of facilities that have capacity available for complementary testing performed in accordance with specific test methods.

It is essential to develop a common understanding about how each world-class RI could be used to address the Grand Challenges and other identified needs. To become a valuable tool for networking between researchers, it is also important to promote the RI's capability and its contribution to advancing science and developing new knowledge to benefit the international research community. The more RIs are listed in this database, the greater will be its value.

Parallel to the marketing of the database itself, the promotion and publicity of organisations, research projects and research results aligned with the intent of this tool are necessary. It is recommended to do this during special sessions at international events, on the WebPages of intermodal organisations or via domain-specific publications.

If all of the above recommendations are implemented successfully, it will allow for the identification of RIs and their potential for collaborative use on a broad international and intermodal basis to achieve common goals.

Level 3: Establishing networks around special research topics (CONSOLIDATION)

Before initiating formal cooperation, consolidation of the goals achieved thus far is important. Experience has shown that it is not enough to only rely on the database (Level 2) if there is no interaction between researchers or between individual organisations. It is necessary to build up a climate of trust and understanding between organisations and researchers in order to facilitate the sharing of information, knowledge and experience. Only in such a climate will sharing of results between partners be possible.

The goal to be reached at this level would be the creation of a pool of expertise founded on mutual trust. There are no tools that can force the creation of trust, but by becoming more familiar with other organisations than their researchers and by working together on projects, the level of trust will certainly improve.

It was mentioned in the interviews that the creation and maintenance of networks is time-consuming and expensive, and that there is a risk of spending time and money without receiving direct benefits. This barrier can be overcome partly by contributing funding to support bi- or multinational meetings and projects. On the other hand, it requires the willingness of the partners to spend time on improving the network. If potential partners are not willing to invest money and time, it can be assumed that they have not (yet) reached the final stage of Level 1 with respect to cooperation on RIs. In this case, it will be necessary to revert back to a lower stage in the “Levels of networking” (Figure 2).

Level 4: Sharing knowledge and experience (KNOWLEDGE SHARING)

On Level 4, more active involvement is required to achieve cooperation between organisations. By reaching Level 3, partners with similar equipment or facilities should have demonstrated intent and would have entered into an agreement to cooperate with each other. The aims of Level 4 are the further development of existing methods (and their validation through round-robin testing) and the exchange of knowledge and experience by the exchange of staff or by having joint workshops/seminars/courses.

The main goals are to build capacity within a network developed on Level 3, centred on specific types of RI through the sharing of RI-related knowledge and experience. Outcomes would include harmonised standards, improvements to test methods and equipment, and economies of scale resulting from increased production, realised through improved operational efficiencies.

The obstacles and barriers identified at this level can be summarised as follows:

- Legal barriers,
- Political barriers,
- Legislative restrictions on information sharing,
- Cultural differences,
- Language difficulties.

Some of these barriers (legislative restrictions and political barriers) can only be solved at a political level. The EUTRAIN-project can list these hurdles, raise

awareness and highlight the importance of addressing the issues if the goals of the shared use of RIs are to be attained, but ultimately these issues would have to be resolved at policy level. For the common or networked use of RIs, it is, for instance, inevitable to have open access and wider dissemination of data. On the other hand, and as experience has shown, legal barriers at a more basic level can often be overcome by the persistence of the partners and the adoption of appropriate contract administration and management practices.

Regarding the cultural differences, it is important to be aware of them and to act open-mindedly. This implies that not every researcher might be an appropriately qualified person to collaborate within an international network. Overcoming cultural differences, including language difficulties, depends on the construct of the team and the disposition of the individual team members.

The expected benefits at this level include:

- Accelerated development through sharing expertise and experience,
- Development of critical mass for RDI,
- Attraction of international researchers of high reputation,
- More uniform and harmonised approaches that will improve research efficiency and international transferability of research outputs (i.e. improvement of the value of data sharing),
- Greater cooperation for identifying and developing new technologies, and for the provision of support for the upgrading of RIs.

Level 5: Linking through common RIs (FORMAL COLLABORATION)

Collaboration on Level 5 comprises the establishment of common projects around at least one RI, where the RI forms an essential basis and common resource for a project. Collaboration is founded on formal agreements between the partners in which the responsibility of each partner is clearly defined.

The aim is to create, develop and/or deploy RIs using the best available expertise and knowledge from each partner. Usually, the RI will be located in the country of one of the partners. This means that on the one hand this partner will have a benefit because of the local presence of this infrastructure, but on the other hand he will also have to carry the responsibility (and costs) for the maintenance and management of the RI on behalf of all partners.

In EUTRAIN Deliverable D2.1, a number of obstacles and barriers concerning collaboration on Level 5 were identified:

- Legal barriers,
- Usually there is no or limited insurance cover for government-owned RI,
- Intellectual property regimes (IPR) are often a hurdle for transferring the outcomes,
- Additional costs for partners (e.g. for travelling and insurance),
- Physical condition of RI due to financial constraints,
- Difficulties experienced with international transfer of funding.

To overcome the barrier of insurances, it is possible to manage and operate the RI with assistance from the owners of the RI. If possible, i.e. if the RI is mobile, the transfer of RI to another country with fewer restrictive legal barriers can be considered to overcome legal constraints.

Some organisations expressed concern that international collaboration involving RIs might lead to additional costs resulting from, inter alia, the necessity to travel and to pay for the accommodation of researchers. This concern has to be investigated in each individual case, but cost savings generated by the shared use of RI should be factored in. In general, it can be stated that the more expensive an RI is the higher will be the savings generated by the shared use of the RI.

Generally, an exactly balanced exchange between collaborating partners is seldom achieved, but this should not be the aim of the collaboration effort. The aim should be to link the best expertise, experience and knowledge of the partners with the best hard and soft infrastructure at their disposal to achieve the desired outcomes of the RDI programme. Good collaboration between partner organisations and their researchers should stimulate the discovery and implementation of more efficient and effective RDI approaches, based on cross-pollination of each partner's expertise and experience, resulting in collective gain providing benefits to each partner. Again, all partners should have an open-minded approach.

Benefits that can be achieved at this level are:

- Creation of research networks, centred around world-class RI, yielding high-level RDI outcomes;
- Through international collaboration involving RIs, achieve collective impact and economies of scale;
- Catalyst for greater collaboration across borders;
- Creation of opportunities for the establishment of new, world-class RIs;
- Accelerate the development of new/harmonised standards;
- Agreement on IPR and transferability of RDI data, outputs and outcomes.

If the cooperation has been proven to be successful and all issues were resolved through mutual agreement, there is a high probability that follow-up projects will be generated. Before Level 5 can be achieved, experience has to be gained on international networking and cooperation on Levels 1 to 4. The evaluation of the questionnaires and interviews as well as bilateral meetings have shown that, especially on international level, efforts on Level 1 to 4 would have to be intensified in order to be able to reach the final level of collaboration.

4.5.3 Recommendations for the realisation of international cooperation on RI

4.5.3.1 Within the Global Context

Central to all future activities is to increase the shared, cross-border utilisation of existing RIs in all modes of transport by improving networking and facilitating relevant knowledge exchanges between scientists and experts working in these spheres.

To realise and/or strengthen international cooperation on RI, it is essential to increase the profile of existing RI, as well as to raise greater awareness of the RI capabilities and the need for new RI. The necessity for and the benefits of international cooperation on RI should be promoted on platforms representing the interests of international organisations involved in transport research. This could be achieved through ETRA and by making use of platforms such as TRA and TRB. Other avenues are meetings between parties involved in European and international research projects and bi- and multilateral meetings between research organisations, where the necessity and benefits of the common and shared use of RI should be promoted. Successful examples of common use of RIs are helpful to support this aim.

A very useful tool for identifying potential cooperation opportunities that involve RI is the RI Online Catalogue on the FEHRL internet site (<http://www.fehrl.org/index.php?m=347⁵>). The international community should be made aware of the availability of this tool. However, to increase its potential as an international tool, it is necessary to improve and expand the

⁵ The RI Online Catalogue includes the following information:

- Contact and location information, including availability;
- A description of the RI.
- Reference projects,
- Categorization – labeling.

content of the catalogue and broaden its scope to cover all transport modes. When improving the tool, the following aspects should be focussed on:

- Increasing awareness of the database;
- Expanding the scope of the database to address all transport modes;
- Addition of new items covering all transport modes;
- Addition of new items from non-European countries;
- Translation of the information in different languages; and
- Improvement of the tool's user-friendliness.

By achieving the above, the RI Online Catalogue would have the potential to become a marketplace for high-level RIs and a very valuable tool to stimulate and facilitate international cooperation. Furthermore, this work would assist in identifying missing RIs.

It is recommended that an International RI Task Force for all transport modes be established to formulate recommendations and promote actions for networking and for information and knowledge exchange on world-class RIs, and to identify requirements for new RIs linked to the Grand Challenges in particular. Research organisations that have already acquired good experience on the above should share their know-how and should be invited to participate in the International RI Task Force.

In either case, i.e. dealing with existing RIs or the creation of new ones, the first step will be to formulate a common view on the need for RIs (the WHY), the anticipated impact (the RESULTS), the means for cooperation (the HOW), and, finally, the priorities (the WHICH).

If the conditions are ripe as per above statement, this RI Task Force should create a Working Group on RIs (WGRI). This Working Group should have as its purpose to investigate the issues and instigate coordinated actions for the development of new RIs. The WGRI should provide recommendations on the selection of which RIs to promote by priority and submit those to the RI Task Force. In particular, the tasks of the WGRI would be:

- To investigate the needs and priorities of relevant stakeholders and prioritise RIs in terms of their need and value added.
- To set out the rules on how to proceed with the implementation of the priority RIs, i.e. formulate the roadmaps.
- To cooperate with the Global Transport Research Alliance (see below) in order to promote the necessary actions for the implementation of these priority RIs and mobilising other interested countries.
- To advise on sources of funding as required.

At the high end, a Global Transport Research Alliance could be instituted. This Alliance could assume the format of a collaborative platform with strong political connectivity, aimed at mobilising the best science, engineering and technology to address the Grand Challenges in transport across all modes through innovation and the adoption of multiple-disciplinary approaches. The goal should be to yield collective impact at an international level, as well as transferable outcomes for deployment at regional and national level. With respect to Research Infrastructure, the International RI Task Force referred to above could then either be integrated within the structures of the Alliance, or operate in support of the Alliance. The Alliance, in association with the International RI Task Force, would then be able to identify and agree on the RI needs for the different modes, draft international roadmaps towards their realisation (similar to the ESFRI roadmap within the European context), identify sources of funding for collaborative projects involving existing RI as well as for the establishment of new, world-class RIs for the transport sector in line with the Grand Challenges and other priorities of the Alliance.

4.5.3.2 Within the European Context

To reach the above ambitious and challenging goals, it is necessary to have both a strong community of stakeholders and support on a political level. The equivalent of the Global Transport Research Alliance at European level is the European Transport Research Alliance (ETRA), which is a stakeholder community for all modes of transport. One of ETRA's five main actions in its 4-Year Activity Plan 2013-2016 is to promote *"the easier access and availability of transport research infrastructures (RIs) to a wider circle of individual researchers or research organisations as a way of giving more freedom for conducting cutting edge research, and to achieving higher utilisation of RIs"*. ETRA would thus support cooperation in order to achieve economies of scale by, for instance, reducing duplication in expenditure. The approach will be *"to establish increased networking around existing RIs and to assist or even promote initiatives – to be undertaken by the relevant and directly involved organisations – to develop new RIs commonly available to European researchers"*. Although ETRA is a European alliance, non-European interests are somewhat represented in the membership base of the ETRA partners. Also, the activities of ETRA should attract international interest and stimulate international cooperation.

The activities of ETRA have to be supported on a political level. The different stages of the roadmap, i.e. networking, cooperation and collaboration, leading to the final Level "FORMAL COLLABORATION" (section Roadmap for international collaboration on RI), can be directly linked to the approved instruments of the European Framework Programmes: Marie Skłodowska-Curie

Actions, Coordination and Support Actions (CSA) and Collaborative Projects (CP). There is the potential to improve access to these instruments in the next Framework Programme for Research and Innovation of the EC, namely Horizon 2020, by facilitating the participation through more simple and easier administrative instruments as well as by opening up and simplifying international cooperation with partners in third countries.

Funding by the EC should further be considered for the support of networks and clusters to bring together and integrate world-class RIs, especially for the transnational and virtual access of researchers to these RIs.

It is imperative that large, critically important transport-related RIs be incorporated in future ESFRI roadmaps – transport-related RIs do not feature in current roadmaps. The Conference of European Directors of Roads (CEDR), ETRA members (e.g. ECTRI, EURNEX, FEHRL, FERSI and HUMANIST), in association with other stakeholders such as universities, should initiate dialogue on the need for new, major transport-related RI. The first step should be to identify the national needs and to ensure that transport-related RI features on national roadmaps. Also the national representatives on ESFRI should be involved. A Thematic Working Group on RIs consisting of the European members of the WGRI should be established to facilitate this dialogue. Once the needs for new RIs have been articulated, the next step would be the drafting of ESFRI proposals for transport-related RI and the subsequent endorsement of these proposals by a delegation of national experts which has the task to submitting this draft to ESFRI. Upon approval by the ESFRI Executive Board that the proposal can be subjected to the ESFRI review process; the Thematic Working Group would then take this process further. If the outcomes are found to be positive, the identified RIs could then be listed in the ESFRI roadmap, which will greatly assist towards the implementation of the RI.

The following four RIs, identified by experts contributing to the DETRA project and representing the different transport modes, could possibly be considered as candidates for submission to ESFRI:

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; and
4. European Road Infrastructure Testing (ERIT) facility.

These RIs would bring additional value to the European transport sector in its strive to address future challenges. It is essential that the process of identifying

missing RIs be initiated as soon as possible, taking current recommendations, in order to be able to address the challenges facing the transport sector.

5 RESEARCH TRAINING AND HUMAN RESOURCE ISSUES

5.1 Introduction

Within Europe there have been wider moves to improve support to European knowledge research and innovation activities from which transport research will also benefit. There is a European Research Area (ERA) framework proposal in 2012 to create a single market for knowledge research and innovation. This would be complemented by the Horizon 2020 programme which would aim to boost support in key ERA priorities – mobility, infrastructures, knowledge transfer, and policy learning. The programme aims to develop stronger partnerships with Member States and private sector to invest more efficiently in knowledge research and training.

This chapter looks at some current practices that can help with training and collaboration by transport researchers and institutions, identifies some key issues that if addressed could improve collaboration further and provides recommendations for further consideration by the European Commission.

5.2 Current Practices and Key Issues

5.2.1 The Marie Curie Actions Programmes

Marie Curie Fellowships are European research grants available to researchers regardless of their nationality or field of research. In addition to generous research funding scientists have the possibility to gain experience abroad and in the private sector, and to complete their training with competences or disciplines useful for their careers. Read more about various funding schemes and requirements for applying. There are nine key programs that make up the Marie Curie Actions Programme such as Initial Training Networks (ITN), Industry-Academia Partnerships and Pathways (IAPP), Intra-European Fellowships (IEF), International Incoming Fellowships (IIF), International Outgoing Fellowships (IOF) etc. Many of the programmes are aimed at encouraging mobility of researchers to leave Europe and work worldwide (and bring skills and knowledge back to Europe) and for other

world-wide researchers to come to Europe to share their knowledge with European research teams.

Overall, the Marie Curie Actions Programmes have been considered successful in terms of encouraging mobility of researchers between EU and other countries. However, the Marie Curie programmes can be problematic for research organisations where the balance of the gains between research organisations swapping research staff can be lopsided. Stronger research organisations may find limited benefits from their researchers spending time in research organisations with weaker grasp of a topic (which maybe in a developing country), but they will pay significant costs. In these cases helping the stronger institution with meeting staff costs would be beneficial and may encourage more organisations to sign up to these programmes. Additionally by strengthening the career development benefit offered by the experience so that the opportunity is more attractive to individual researchers. It is unusual to find funding for swaps between two relatively strong research organisations on a similar topic which would be useful to many research organisations. These swaps may help with standardisation and harmonisation efforts in the future.

5.2.2 Network of Excellence Projects

Network of Excellence (NoE) projects are one type of medium sized projects in FP6 and FP7. Such projects often aim at creating a visible and integrated community of researchers on one thematic area, identifying and increasing topic awareness, and steering academic research efforts towards industry-relevant issues without forgetting fundamental scientific issues. Many of NoE projects have tasks in producing training materials (e.g. academic textbooks), and organising short training courses (e.g. summer schools). Most of NoE projects gather leading Academic Institutions across Europe in one specific field. Some of them also cooperate with leading institutions in the field from industrialised countries, mainly the United States of America.

The technological developments require training of staff in the transport sector to adapt to these developments. Training has substantial impacts on future prosperity, sustainability and the competitiveness of the European transport sectors. The fast development of technologies, e.g. in the field of Intelligent Transport Systems (ITS), makes current text books and engineering training materials out of date very fast. Training of transport researchers requires appropriate training materials which will feed the curricula and make a training course attractive and valuable. NoE projects gather experiences from past research projects clustered around thematic areas, in order to

systematically summarise the state-of-the-art. Materials provided by NoE include textbooks, engineering reference books, academic papers and booklets.

Many NoE projects offer short training courses such as a summer school. A summer school may not be free of charge but has a small fee. Attendees of a summer school are often research students or young researchers from Academic Institutions. Such a summer school is often able to attract international students, which lay a foundation for future cooperation and networking.

Overall, NoE projects are a tool to provide training courses and materials. However, NoE projects often have many tasks such as creating a network, general disseminations, thus resulting in spending resources in project management and only limited resources in producing training materials and organising training courses. Moreover, the involvement of international institutions is often limited.

5.2.3 Dissemination activities of R&D projects

All R&D projects have dissemination activities and specific and significant amount budget which is 100% funded by the EC. Since project dissemination is a key indicator for the EC to evaluate the success of a project many R&D projects spend significant efforts on dissemination activities by creating project identities, organising public events, printing brochures etc.

There is no doubt that dissemination activities are important for knowledge transfer. Key media used for project dissemination are project websites, workshop/seminars, factsheets and brochures. Project consortia are also encouraged to present project results at international conferences. To address international audiences, some projects organise project events as side event at international conferences. Web conference, also known as Webinar, has been widely used to disseminate projects. Benefits of web conferences are reducing logistics cost, attracting international audiences, and saving travel cost for both consortium members and external participations.

Dissemination activities are essential to raise awareness of a R&D project and can have impacts on exploitation of the project outcomes. However, the current practices have the following issues which may devalue the dissemination efforts and have negative impacts on EC funded R&D projects:

- EU funded projects have an acronym. Some acronyms may reflect contents of a project such as CVIS (Cooperative Vehicle Infrastructure Systems). Some acronyms however have no direct relationship with the contents. Since giving acronym and creating a logo for a R&D project is a special approach in EU only, international partners are often confused by those acronyms. European organisations often disseminate outcomes of a project in the outcomes under the brand of the project name. Since the name of the project may not reflect the contents, materials from the projects may not reach the right audience.
- Dissemination activities are only sponsored during the period of a project. Often, project presentations and papers during the project period are only general introduction of the project activities, work plan and objectives etc. Only towards to the end of a project are scientific results good enough to produce high quality publications. However consortium members then have neither time nor budget to present the final results in international conferences. The best part of the project then may not be disseminated to international stakeholders, thus reducing impacts and exploitation opportunities.
- Many EU funded R&D projects print brochures, factsheets and other dissemination materials. Those printed materials often focus on general introduction rather than real results. Therefore, they are not particularly useful for international stakeholders, who are not interested in project descriptive data such as the length of the project, consortium members and funding schemes.
- A project website is also often in operation during the period of a project. After the end of the project, all contents in the website may not be achieved. It is difficult to find deliverables, reports and other dissemination materials from past R&D projects, resulting in limited impact on dissemination activities. Again, since good results are only produced at the end of the project, the consortium has limited time to reach wider audience. Long term funding for project websites may also not be available leading to a loss of accessible information when the project web site is shut down.

5.3 Recommendations to future funding scheme

A number of recommendations have been generated by feedback on research training and human resource issues. These have been separated into various topic headings below.

5.3.1 Marie Curie Funding of Researchers

Reforms are recommended to the Marie Curie funding process related to the following aspects:

1. Help with funding of the supervisory aspects of the hosting institutions in European funded support programmes. Without funding support many research organisations without national government support find supporting researchers from other organisation to be significantly burdened by additional costs, making it unlikely that they will support these initiatives.
2. Increase the allowable percentage of commercial work that an EU supported researcher can undertake for the institution they are working for. As this will bring commercial experience and skills for the individual and help with managing institutional costs especially those organisations with no Government funding.
3. To help some institutions increase the skill of staff, funded structured mentoring should be considered as suitable for funding under the Marie Curie Scheme.
4. Consider increased incentives for stronger and more commercial European research institutions for providing highly skilled researchers to developing research organisations.

5.3.2 Researcher Database

Potential exists for a new “Skilled Transport Researcher section” in the EU website for organisations looking for skills and potentially offering skilled researchers and looking to temporarily move countries to gain experience or for personal reasons. The site would cover:

- Information on institutional benefits or collaboration and temporary secondments of transport staff in the EU and Internationally.
- Information on the current financial incentives to organisations and individuals of collaborating by relocating to other research organisations.
- A database of requests of organisations looking for temporary secondments to improve skills or for individuals/organisations offering skills for secondment.

5.3.3 Recommendations for dissemination of R&D projects towards an international audience

It would be beneficial that larger EU funded R&D projects should have specific tasks in dissemination activities towards international cooperation. This

would increase international research collaboration and potentially make world markets aware of the research capabilities and skills within the EU. These then may develop into commercial collaborations which will benefit both the EU and other countries. Such dissemination activities should be contents and results driven instead of project identity oriented.

Moreover, a grant could be set up to fund researchers enabling them participate international conferences and present results of a finished project, or publish results, e.g. using open-source online journals. R&D project dissemination budget during the project period may be reduced in order to have such a grant. Dissemination materials and conference papers to give only general introduction of a project should be discouraged. Dissemination should more focus on publishing results and data rather than raising awareness. That would make a longer term impact increasing the value of R&D project dissemination and more efficiently use the dissemination budget. Keeping a project website running for a number of years (e.g. 3 years) after the project finishing would help project dissemination. However, results from all EC funded R&D projects may be achieved properly through a centralised database. The centralised database may be a part of an online education tool which would help transport researchers around the world enhancing their skills and will mean that results and data are retained into the long term. Such online education tools can also help develop researcher networks and help foster future collaborations.

Dissemination activities may have budget for external stakeholders from outside the EU to join project workshops which can provide helpful sources of networking and collaboration for transport researchers. Funding could be targeted toward different transport stakeholders groups such as policy makers, researchers and practitioners.

5.3.4 Training and education material and short training course

Although NoE projects have been used to provide training and education materials and organising short training courses specific international cooperation projects aiming at producing high quality training and education materials and running training course would be more efficient. Such projects would gather leading Academic Institutions in transport research and education worldwide to address a thematic topic which has been experiencing a fast development in technologies. Such projects may be small (four or five partners) and short (one or two years), and focus on only

publishing web based material, textbooks, guidelines or other training materials or organising appropriate training courses.

6 HARMONISING PROCEDURES AND ATTITUDES FOR INTERNATIONAL COOPERATIVE TRANSPORT RESEARCH ON A GLOBAL SCALE

6.1 Institutional cultures and governance regimes

Institutional cultures and governance regimes are specific issues of primary importance for international cooperation according to the current experiences. The importance of Institutional culture lays in the profound impact it has on the work environment and the ability of members of an institution to succeed. Research governance of each individual country has a direct influence not only on the execution of research and therefore its results but also on the definition of priorities among collective problems in different societies (Jacob 2012). It is therefore very important to address the issues in order to ensure successful global collaborative research, i.e. with participation of different countries and involving different institutions and governance regimes, to develop and make acceptable form of a common culture and research governance. Harmonising institutional cultures and governance regimes is hence of prime importance and has the potential to overcome obstacles and barriers in order to create an adequate environment for successful cooperation among different countries.

6.1.1 Description of a “vision” for future research related institutional cultures and governance regimes

Current research approach in different countries has developed different institutional culture in different countries and different types of organizations. Such culture has influence on the way to address transport issues and develop transport policy, thus have great impacts on transport research. Since transport issues are often local (e.g. congestion) and transport policy is often politically oriented current transport research often lacks of shared commitments and values to a wider range of cities and countries even though such research can be transferrable to other cities and regions. Consequently, fostering the development of a more adaptable institutional culture in different countries is one of the first steps to assure success in cooperation.

Establishing an International Cooperation Promotion and Networking Centres (ICPNC) is proposed in order to foster international cooperation actions and build human capacities in transport research. This proposal aims exactly at promoting a new world class level of research institutions and researchers in different countries and assisting the reinvention process of existent centres to achieve better international cooperation capabilities.

Institutional cultures in the “future world class level research institutions” should be more aligned towards a strategic typology —focusing on global challenges, with integrated vision, and extensive networking. These research institutions should follow three steps as shown below in Figure 3.



Figure 3 Steps to address institutional culture to crate ICPNC

It should start with a consultation phase to develop a comprehensive understanding of different institutional culture and potential solutions to address such difference. Key members of ICPNC should be identified and those key members should be surveyed in order to understand their institutional culture and potential obstacles caused by such culture in ICPNC. The second step is to raising awareness of such difference among key members in order to facilitate discussions on how to address the difference. It should be noted that few transport researchers have a broad view on either institutional cultures of different types of organisations (e.g. public or private, local or national) or similar organisations in different countries.

By raising awareness of such difference, a common strategy to address the difference can be developed. Development of the common strategy would be an outcome of intensive discussions and dialogues among all potential members. The strategy should take into account the differences and propose a solutions on mitigate potential negative impacts on activities of ICPNC.

Future governance regimes and policymaking competencies could be gradually re-aligned and adapted to a more cooperative regime at the multinational level in terms of internal organisation, new political agendas setting, decision making regulations, and implementation procedures, and other relevant areas. Such process of change could be assisted by the creation and operation of a Conference of Global Research Cooperation (CGRC) i.e. a new international Organisation that should be created to act as the body that promote a more harmonised research governance and

incorporating the ICPNCs as shown in Figure 4. The CGRC could be created under an International Protocol signed by the interested countries. The Protocol should be accompanied by a document specifying the main rules and procedures that would guarantee the correct operation of the CGRC.

The main body of the governance structure should be a Council constituted by highly qualified senior researchers well known in the international community for their work and contribution to research. The Council members should be elected by each of the countries or regions. Within its duties the Council will manage the CGRC affairs, approve the CGRC general budget, evaluate request of membership for new countries, evaluate the policies and programs of CGRC, maintain the CGRC's financial integrity, direct the enforcement procedure if needed and other specific functions that could be attributed.

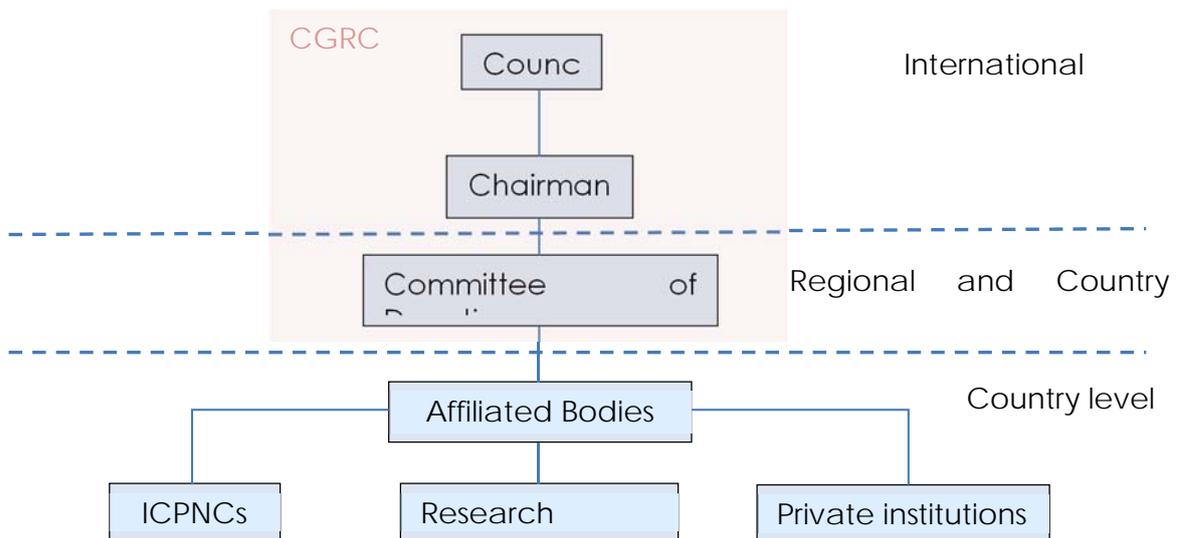


Figure 4 Future governance structure

The Committee of Deputies should be composed by researchers, officials from Ministries (e.g. Transportation Ministry), delegates of the regions, and interested actors from the private sector. It should be convened as many times as needed during the year to prepare, proceedings, prepare documentation including proposals to be submitted for approval to the Council and to deliberate on the matters that each of the different ICPNCs submit to be evaluated e.g. topics and issues of interest on transport research, interested countries and private parties in certain research projects, resources available etc. The Committee of Deputies should also monitor actions taken on each of the participant countries and performance of projects.

Affiliated Bodies can be the ICPNCs, *the various* research organisations, and Industrial players that belong to the countries of interest. These bodies will provide work that assists the general aim of the “Conference” e.g. technical assistance, harmonisation proposals and harmonisation implementation actions, networking etc.

6.1.2 Potential steps towards achieving global research harmonization

Global harmonization of institutional cultures and governance regimes cannot of course come from one day to the other. There are a number of very complex and time consuming steps and stages that have to be followed in order to be able to meet future challenges towards more international (transport) research collaboration. The following possible steps may be followed (Beer 1990):

1. Further investigating the problems and mobilizing commitment to change, through joint diagnosis of these problems focusing on those that hinder cooperation between countries with institutional cultures and governance regimes, in order to adapt organizations to cooperate.
2. Develop a shared vision of how to organize and manage global (transport) research cooperation.
3. Foster consensus for a new vision of (transport) research, gather competence to enact this new vision, and achieve cohesion to move it along globally.
4. Spread revitalization spirit to all parties involved in the countries of interest avoiding to adopt a scheme in which “funding” countries are “imposing” their views on “recipient” or “lesser research oriented” ones.
5. Institutionalize revitalization through formal research policies, systems, and structures.
6. Monitor and adjust strategies in response to problems in the process of harmonization.

The first step has already been implemented from the point of view of transport research by countries within the European Neighbourhood Policy (ENP) where transport policy is already a key element of both, multilateral and bilateral dialogs. In other countries and regions of interest the first step should be implemented through an incremental approach as recommended in D2.1. Based on improving the mutual understanding of each other's limitations, motivations, and framework conditions would serve to better identify which specific countries may be interested in joining an international

collaborative research effort within one specific area, and how they could reasonably react to the collaborative efforts in terms of funding contribution, speed of deployment, mobilization of key stakeholders, etc.

Establishing effective and multi-channel communication processes will enhance collaboration between developed and less developed countries as suggested in the EUTRAIN bilateral meetings. To develop a shared vision of how to organize and manage, the second step mentioned, global organisations and the major donor countries should start working on efforts at promoting know-how transfer, organizing workshops and fostering networking aimed at creating compatible conditions for research governance. These activities should lead to foster consensus for the new vision, competence to enact it, and cohesion to move it along (the third step).

To achieve the fourth step, spread revitalization to all parties without pushing it from the top, information on the key issues of research in each country should be used to develop “equal” joint research agendas. Feedback collected from workshops/surveys has revealed that some of the joint research programmes offered for international transport research cooperation are not of equal interest and importance to both sides and that they simply express the interests of the “funding donor” countries. A clearer understanding of issues of interest and necessities in transport research in different countries, used to design joint research programmes of common interest, would develop a different perspective and motivate a positive impact in less developed countries to work on a better research structure.

The creation of ICPNC, will allow meeting the fifth and sixth steps, i.e. institutionalizing revitalization and monitoring/adjusting strategies. ICPNCs, run by the research community, would set formal policies, systems, and structures to foster international cooperation actions and human capacity building focusing on major global transport related problems.

6.2 Intellectual Property in International Cooperation

The issue of Intellectual Property Rights (IPR) in collaborative public funded research is a key issue, particularly in the context of commercial exploitation of research results. Different countries have different principles on intellectual property generated from public funded research. Yet there is not much conflict into this issue at the EU level and international level. However, IPR could be a serious issue for international cooperation research. A common

strategy and framework is needed in order to prevent conflicts and maximise benefits of research results. This section analyses intellectual property rights in an international context and gives recommendations for future cooperation.

6.2.1 Findings

The Intellectual Property Rights (IPR) applicable in the Seventh Framework Programme (FP7) of the European Community for research, technological development and demonstration activities (2007-2013) give guidance on various issues and potential pitfalls regarding IPR that participants may encounter when preparing and participating in an FP7 project. Overall, participants are strongly encouraged to consider and tackle IPR issues as soon as possible during the preparation of their project and to negotiate any relevant questions with the other participants before starting the project. Indeed, IPR issues can affect both the way a project is conducted, and the exploitation of results after the end of a project. Moreover, certain provisions foresee a default regime if no alternative agreement has been reached.

The European Research Area Guidelines on Intellectual Property (IP) Management in International Research Collaboration Agreements between European and Non-European Partners propose three main elements of an effective system to protect and exploit IP:

- a system that enables the protection of IP (e.g. patents, copyrights, brand, industrial design) that includes clarity about the ownership of IP rights, rights to use IP, the rights and freedom of parties to transfer (assign) IP and the freedom to publish;
- a technology transfer framework, preferably with the provision of specialised knowledge transfer offices with professional staff;
- a fair law enforcement system in partner's countries that caters for dispute settlement but also that can award penalties and sanctions where appropriate.

The US FHWA Transportation Research Program Administration in Europe and Asia has analysed the issue of intellectual property rights in international collaborative research:

Addressing IPR is a common practice that facilitates the delivery of transportation research results. Europe has a decidedly different perspective than the United States on the ownership of intellectual property generated from government-funded transportation research. IPR is addressed before the transportation research is initiated and included in the research partnership contract. In general in Europe, development is seen as an opportunity to build

a business based on the specific IP, creating an economic engine for the country. There is no barrier to government-funded organizations seeking patents. In fact, for France's LCPC, the number of patents, along with the results of application, is a performance measure used to evaluate the program.

In conjunction with the intellectual property issue, an important element of Japan's MLIT Technology Basic Plan is dissemination of R&D results by tracking and facilitating use and evaluating new technologies. The New Technology Information System includes a private sector intellectual property strategy, which fosters the introduction of new technologies into public works projects and promotes R&D in the private sector. Benefits of this process include better data for use in the evaluation information system; a more robust process for promoting use of research results, new technology, or innovation; increased speed in producing evaluation results, which speeds deployment; and strengthened cooperation and information sharing with local governments, which play a large role in dissemination and deployment activities.

Japan's PWRI also tracks and uses as an indication of "practicalisation" (application to practice) of its research efforts the number of patents owned and applications for patents and registrations. Fees received through ownership of intellectual property help fund the dissemination of research results. This means the direct financial benefits of the intellectual property are invested in the application of new technologies and innovations.

The transportation research community is charged with finding solutions to problems. Those solutions often involve new processes and technologies that represent intellectual property with potential economic value.

The transportation research community demonstrated a noticeably greater concern for the value and importance of intellectual property than is sometimes evident in the United States. Safeguarding intellectual property was recognized as a critical component of the entire research process to spur innovation, encourage investment for technology development and refinement, and foster commercialization nationally and internationally. Ultimately, intellectual property was seen as a means to bolster national economies by adding companies that hire new employees and sell new products. Successful management of intellectual property was associated with greater trade and foreign global investment.

In the United States, public agencies have traditionally taken the position that they should retain rights to intellectual property derived from their research.

While the intent of this policy has been to maintain public ownership of intellectual property, an unintended result has been to impede development. Frequently, Federal agencies have lacked the resources and impetus to commercialize technology or license it to others, and in the absence of intellectual property protection, private concerns have been reluctant to invest in its development. Other public agencies, such as State DOTs, have taken a similar approach with similar results. In contrast, organizations visited during the scan viewed protection and licensing of intellectual property as essential enablers of technology deployment.

Furthermore, many transportation agencies in the United States lack effective policies on employees' rights to intellectual property. For example, any new product or idea that relates to a Federal agency's goals and objectives is owned by the agency because Federal employees are required to assign their intellectual property rights to the government. Undefined policies or policies that preclude employees from sharing intellectual property rights create little incentive for innovation in State and Federal transportation agencies.

A significant barrier to more effective management of intellectual property is the lack of understanding among public transportation agencies of domestic and international intellectual property law. Although the Bayh-Dole Act governs intellectual property developed in federally sponsored research, Federal and State agencies often lack expertise on the fairly complicated and often expensive processes needed to secure and protect intellectual property rights domestically or internationally.

Before the Bayh-Dole Act, federal research funding contracts and grants obligated inventors (where ever they worked) to assign inventions they made using federal funding to the federal government. Bayh-Dole permits a university, small business, or non-profit institution to elect to pursue ownership of an invention in preference to the government. Few public transportation agencies have legal staff or retain counsel specializing in intellectual property law.

Differences between intellectual property laws can complicate or frustrate protection and licensing between organizations in different countries. Organizations in nearly every country visited during the scan voiced questions and concerns about international intellectual property rights.

A report of the TRB-ECTRI Working Group on EU-U.S. Transportation Research Collaboration entitled "European-United States Transportation Research

Collaboration Challenges and Opportunities” has also analysed the issues of IPR and in particular examined the open-source approach:

Within the surface transportation community (in both Europe and the United States), there has been an underemphasis on the use of intellectual property (IP) and open-source methods to stimulate the deployment of highway innovations and technologies. In this regard, it is a relatively simple task to tally the numbers of patents and licenses generated by the transportation sector to see that the numbers pale in comparison to those generated by other industries such as biotechnology. One of the barriers to the use of IP to spur the generation and commercialization of new innovations is the surface transport sector’s (at the federal and state levels of government) tendency to view transportation innovations as a public good that should be freely available. This attitude is changing (at least in the academic community) as universities look at intellectual property and licenses as an important sources of additional revenue and as incentives to retain intellectual talent.

Somewhat paradoxically, the use of open-source strategies to promote the broad development and use of innovative technologies also was not optimized until relatively recently. In the United States, for instance, some modeling and simulation technologies have often been developed and maintained solely by the federal government. This “cradle to grave” approach has left little room for entrepreneurs interested in refining and selling traffic management tools. Recently this approach has begun to change, with the federal government gradually moving toward the position that it should focus on basic research where funding is typically scarce. The private sector would then exploit this research to develop specific applications that could be commercialized to generate profits. Rather than the government restricting access to a particular entrepreneur, as could happen under an IP commercialization regime, all qualified private parties would have equal access to the research findings.

The Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) is an international agreement administered by the World Trade Organization (WTO) that sets down minimum standards for many forms of IP regulation as applied to nationals of other WTO Members. It was negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) in 1994. The TRIPS agreement introduced intellectual property law into the international trading system for the first time and remains the most comprehensive international agreement on intellectual property to date. TRIPS require member states to provide strong protection for intellectual property rights.

6.2.2 Recommendations

Recommendations for addressing the issue of intellectual property rights in future publicly funded international cooperation projects in the transport sector include the following:

- Streamlining national guidelines as part of international cooperation projects
- Defining the IP regime applicable to the project and all partners within the project before start of the project, ideally at the 'call for proposals' stage
- Considering the applicability and benefit of open-source licensing and funding schemes

Overall, the IPR issues in future publicly funded international cooperation projects will related to funding schemes and objectives of projects. Currently, EC funded R&D projects often are often seen as an opportunity to build a business based on specific IP. However, EC funded international cooperation may also address basic research or global challenges. Currently, there are two types of funding schemes for international cooperation projects:

- Demonstration projects receive 50% funding from the EC;
- Coordination and support action projects receive 100% funding.

If a project is 100% funded by public funding, all intellectual property generated (i.e. Foreground of the project) should be public. This should be identified at the "Call for Proposal". Such 100% funded projects should be either address:

- Basic research; or
- Global challenges.

The IPR issue should be clarified in each of the project programmes, i.e. "Calls for Proposal". It should be indicated in the programmes that all IPR or foregrounds generated by a 100% funded project are public knowledge, and everyone including project consortium members are encouraged to exploit the foregrounds of the project for commercial interests. All deliverables of the project should be public and the consortium is obligated to publish all results and disseminate the results to transport professionals and the public. If a consortium member or a third party develops a patent or product based on the project, neither the consortium nor the funding body has the right to claim IP to the patent or the product.

However, if a project is a Public Private Partnership (PPP), i.e. not 100% funded by public funding, consortium members have certain right on IP developed by the project.

Currently in a EC funded project, the IPR issue is guarded by the consortium Agreement. EC has a template for a consortium agreement. However, the final contents of the consortium agreement are defined by each individual consortium.

It is often the case that industry partners (particularly big enterprises) who have a legal department spend significant amount of time on the contents of a consortium agreement and small partners often have no such resources for it and intend to agree whatever proposed by the big entities. International partners are often afraid of challenging the contents. Some partners never signed the consortium agreement during the project period. It would therefore be more practical to have unified agreement on IPR, e.g. as a part of Grant Agreement. For projects which is 100% funded by public fund, the IPR should not be a part of the consortium agreement and the contract should indicate that all information and IPR is public, i.e. everyone and every organisation can use it.

For PPP projects, if IPR is foreseen, pre-agreement on IPR is required in a more specific way, i.e. clearly defining potential joint IPR. Such practices would help partners to plan their activities more carefully when joining a project consortium, which would also help real exploitation of foreground of a project.

6.3 International Cooperation on Standardisation

6.3.1 Overview of standardisation organisations

Developing and implementing technical standards is a long and complex process. Currently, a life cycle of publishing a technical standard is in average 3 years. The goals of right standardisation are to help with independence of single suppliers, compatibility, interoperability, repeatability or quality. However, it has been known the existence of a standard does not imply that it is useful or correct. In the transport field, currently, many standards focusing on transport data which are important for the safe and efficient operation of transportation systems. A wide variety of standards organisations, consortia and groups are involved in producing and maintaining standards that are

relevant to the global transport technology such as traffic data collection, information distribution, ticketing and tolling. The formal development of international standards is organised in three tiers of standards development organisations:

- International Organisation for Standardisation (ISO)
- The European Committee for Standardisation (CEN), the European Committee for Electrotechnical Standardisation (CENELEC) and the European Telecommunications Standards Institute (ETSI)
- Most nations have a coordinating body responsible for organising participating in CEN and ISO activities, for publishing ISO and CEN standards within the country, and for coordinating national standardisation activities. For example, in the UK, the British Standards Institution (BSI) is the National standardisation organisation.

A number of other international bodies undertake work that is important for Transport and Transport Information standards include:

- The Institute of Electrical and Electronics Engineers (IEEE)
- International Union of Railways (UIC)
- European Broadcasting Union (EBU)
- World Wide Web Consortium (W3C)
- Open Travel Alliance (OTA)
- Open Geospatial Consortium (OGC)
- Organization for the Advancement of Structured Information Standards (OASIS)

Standardisation organisations conduct their work through a system of working groups, responsible for different areas of expertise.

6.3.2 Current practices in standardisation activities

European standardisation is a voluntary activity of building consensus in order to create technical specifications that are carried out by interested parties mainly industry partners and research organisations. There is no doubt that industry's participation in standardisation is driven by commercial interests, often for promoting its own technologies as standards. Since standardisation is at a voluntary base, Small and Medium sized Enterprises (SME) often have no resources in such activities, resulting in much participation in standardisation activities. SME representation is reinforced by the European Office of Crafts, Trades and SME for Standardisation (NORMAPME). "Societal" stakeholders who present consumer or end users' view in the standardisation process play an vital role in order to promote user's acceptance for a standard. In

transport standardisation, such stakeholders mainly are motorist clubs or trade unions.

There is a difference between technical standards and standards-receptive legislation. A technical standard is not mandatory except it has become legislation by national or regional authorities.

Some of R&D projects funded by the EC, e.g. FP7 projects, have looked into opportunities to develop outcomes of such projects into technical standards such as CVIS. However, the development of a standard is often beyond the lifetime of the projects. The following-up standardisation activities often are carried on by project partners from industry. Occasionally, such standardisation activities driven by outcomes of R&D projects may receive funding from the EC as coordination or support actions projects. Such coordination or support actions projects are often in the framework of EC's agreement with other countries, e.g. U.S. A. and Japan.

6.3.3 Recommended methods for international cooperation in standardisation

6.3.3.1 The importance of international cooperation in standardisation

International harmonisation in standardisation is essential to promote European technologies and strengthen European competitiveness. Since standardisation activities are on a voluntary basis, in the current economic situation, few industry partners are able to be active. Since participating in international standardisation often requires international travelling, e.g. participating in working group meetings, it requires even more resources. Moreover, since standardisation is a long process (it normally takes 3 years from the first draft technical standard to a published standard), many industry partners now do not see standardisation as a top priority and allocation of internal resources for international standardisation is not as generous as it used to be.

Moreover, with fast growth in their economies, emerging market countries are more active in international standardisation activities in order to obtain the leadership of the global market since emerging market countries heavily rely on international markets; e.g. Chinese stakeholders initiated a number working groups of ISO in the telecommunication field in order to take Chinese technologies to the global market.

6.3.3.2 Current obstacles and how to overcome them

Currently, many R&D projects have activities related to standardisation, often as a part of Dissemination and Exploitation activities. Some of them carried out gap analysis to identify needs for standardisation, including needs for international cooperation in standardisation. Many R&D projects give recommendations to future standardisation activities (often involved with international cooperation) in their exploitation plans. However, few of such recommendations have had real impacts on the future work since there is no resource to support such activities beyond a project's lifecycle. Although those projects results, such as gap analyses and recommendations for future standardisation activities, can be valuable, they are often not in any use neither by consortium members nor by the EC. Many stakeholders interviewed when preparing for this report indicate that they would like to see actions to coordinate usage of existing project results related to international standardisation activities.

With the FP7, EC has supported standardisation activities through coordination and support action projects. Some of them specifically address international cooperation in standardisation, e.g. COMeSafety2. Such projects have proved as successful experiences since resources are allocated and tasks are clear. Such projects are often carried out within international agreements. Success of such projects heavily relies on other partner countries' activities and funding schemes. There were some cases where European partners who receive EC funding through coordination and support action projects were involved with international cooperation in standardisation work (often with the U.S.A. and Japan). However, due to changes in the research agenda and priorities in the partner countries, international partners were unable to receive corresponding funding to continue cooperation with European partners, resulting in little concrete activities being carried out.

Moreover, many coordination and support actions, although aiming at international cooperation in standardisation, often have to carry out general dissemination activities to stakeholders or the public. On the surface, it seems important to disseminate project activities to stakeholders. However, since standardisation is a specific technical task and only few specialists are involved, there is little impact garnered by such non-specific targeted dissemination activities, e.g. organising workshops or seminars, publishing papers at conferences, printing brochures, etc. Furthermore, consortium members often have to use limited resources on such dissemination activities, which results in reduced activities in standardisation.

It has been recommended by many stakeholders from both industry and research organisations that EC's financial supports to international standardisation activities are essential, taking into account that current economic situation does not allow industry to invest much into international standardisation. Current practice to support standardisation through coordination and support actions projects has been approved as an efficient way. Therefore, it may continue. However, the contents of coordination and support actions for standardisation may focus on standardisation mainly and dissemination activities should be significantly reduced. It has been proposed that such projects may not include general dissemination activities in order to focus on standardisation activities only.

There are needs for reviews of needs for international standards, in order to carry out gap analysis and develop new standards. Such activities may be as coordination and support actions projects to coordinate standardisation activities of R&D projects. Each R&D project may have a task to identify needs for standards and international cooperation in standardisation and provide inputs to projects that focus on standardisation activities. Such coordination and support actions projects should be carried out by key industry players, major research organisation and industry associations. To be eligible to participate in such projects, pre-agreements with standardisation organisations and international partners are required. Partners who participate in such projects should be experienced in international standardisations, ideally have been members of working groups of standardisation organisations. Such projects should not focus on dissemination tasks, even though projects may disseminate their standardisation processes to stakeholders and involve stakeholders with standardisation activities. However, the focus should be in standardisation experts.

7 CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE INTERNATIONAL COOPERATION FRAMEWORK

7.1 Overview of the work and method followed Mechanisms for setting priorities and monitoring international cooperation in Transport Research

Setting priorities and topics for future international cooperation projects and programmes has in the past been primarily based on the priorities, the needs, and the interests of the “funding” sides. However, several indications were given that the needs and wishes of the “receiving” sides do not match with those of the “funding” sides and consequently there is a need to rethink and restructure the way that such priorities are set in a more balanced and consistent way.

As regards the criteria for prioritizing the topics for international cooperative research within the new H2020 programme, we recommend the following:

- Mutual interest and benefit between the EU and the partner country (as regards e.g. scientific and technological interest, complementarities, existing research facilities, economic interest, etc);
- Excellence in research performance in the partner sides;
- European research potential in the specific field (need to attain “critical mass”);
- Analysis of risks and opportunities as regards the potential outcomes;
- Past experience from such cooperation between the EU and the partner country;
- Global environment (in the region concerned as regards international cooperative programs of all sorts, existence of activities from other relevant fora, etc).

Besides the importance of setting priorities as regards the topics, it is also of great importance to set effective implementation mechanisms for:

- ✓ Determining the contents for such research cooperation (i.e. the topics),
- ✓ Determining the “partner” countries and / or regions of priority interest,



- ✓ Providing effective information dissemination mechanisms presenting timely information on the opportunities that exist so that all interested research stakeholders are well informed, and
- ✓ Monitoring mechanisms regarding the execution and follow up actions of international cooperation projects in transport research.

To cover the above tasks two types of actions are recommended in order to establish the corresponding “mechanisms” for promoting international cooperation in (transport) research. These mechanisms can be established through relevant EU Commission initiatives acting, preferably, in close cooperation with other major research funding entities outside the EU. The recommended actions, which could be pursued concurrently and as early as possible with initial financing (through corresponding facilitation projects in the H2020 programme), are:

- A. Creation of an *International Transport Research Cooperation “Observatory”- IRCO.* This will be a mechanism for permanent collection, maintenance, and revision of (transport) research needs and priorities around the world with priority focus on the regions of prime interest to the EU. The same “Observatory” would act also as a mechanism for promoting information dissemination and calls to the countries of interest and would advise on specific sources and contact Organisations in “target” countries through which international cooperation activities with EU member countries could be promoted. The “Observatory” would issue regularly “Research Needs” reports would systematically publish collected relevant information and data related to transport research needs in various regions and countries and would be of regular use by the Commission services involved in international cooperation work.

The organisational basis of this “Observatory” could consist of a *central coordinating unit* (either within the EC’s DG RTD) and a number of “supporting” external Organisations (mainly “pioneering” transport research providing organisations located at “key” regions and countries). The technical basis will be a web based electronic platform that will act as a “research needs repository” in which the involved stakeholders will provide input which they have collected through a common methodology. These stakeholders will have to be selected carefully, so as to be independent and reliable. The form of administration and funding for the Observatory as well as the web platform can be defined through a specific facilitation CSA to be assigned once. Through this project this Observatory will be defined, planned, set up, and implemented for an initial period of a few years



before it is handed over to its permanent hosting *central coordinating unit*.

The above mechanism for topic definition and prioritisation, for international cooperative work that will be initiated within H2020, can be complimented with the work of other appropriate entities such as the ETPs or Organisations such as the *European Transport Research Alliance - ETRA*⁶ (i.e. Organisations representing several European transport research stakeholders).

- B. Creation of an international network of experienced and well-motivated (but largely “virtual”) **International Cooperation Promotion and Networking Centres – ICPNC**. This network of ICPNCs will aim at a more strategic and long term promotion of international cooperation activities in transport research. It will consist of a global network of carefully selected “**Champion Organisations**” devoted to building the necessary “capability for international cooperative work” in terms of training actions for the human capital involved, know-how transfer actions, and generally activities promoting such cooperation in specific thematic areas⁷.

The *ICPNCs* will engage in activities such as:

- ✓ Training of research personnel;
- ✓ International know-how transfer and scanning actions;
- ✓ Exchanges of research personnel for short stays in foreign research centres;
- ✓ Organisation of workshops and Seminars;
- ✓ Other related actions, as necessary, providing value added activities aimed at building the necessary networks of cooperating research stakeholders at global level. The strategies of the European Commission for international cooperation in research and innovation as set out in the EC Communication: “*Enhancing and focusing EU international cooperation in research and innovation: a strategic approach*” (COM(2012) 497), should be taken into consideration here.

A first “focus” subject for such an ICPNC is recommended to be: ***transport sustainability and climate change adaptation and mitigation***

⁶ See: www.etralliance.eu

⁷ This recommendation was also made in EUTRAIN Deliverable D3.1.



because this is a subject of global importance and interest and close to the EU's policy of sustainability and decarbonisation in the field of transport – a concern shared by many governments around the world.

Both of the above “actions” can be initially set up through specific *Coordination and Support Actions (CSA)* projects – or similar – which can easily be “delineated” along the lines suggested above and funded through H2020 funds.

7.2 International Joint programming and funding schemes

The experience so far of *European Joint Programming Initiatives - JPis* is the best model we have of a joint international cooperation funding and programming initiative. Promotion of potential *International Joint Programming Initiatives (IJPIs)* can be made along the following principles:

- i. Variable geometry of each IJPI and open access, i.e. based on the needs and configurations of each particular country or grouping of countries;
- ii. Structures that increase the efficiency and effectiveness of the participating States' ability to deal with the large-scale socioeconomic challenges and problems of the future;
- iii. Voluntary in nature, i.e. participation to be based on the simple recognition of the practical usefulness of what is being proposed;
- iv. “Supervision” by a trusted neutral Organization or network of Organisations as a mechanism of “triggering” and monitoring;
- v. Streamlined and simple implementation, i.e. without unduly complex and lengthy management procedures at all levels;
- vi. Short turnaround times from research proposals to research results;
- vii. Managerial Flexibility, e.g. in allowing the possibility to choose, within a range of managerial reference models, the option considered most suitable in the specific case and circumstances;
- viii. Uniform and objective evaluation procedures, applied to all levels and stages according to specifications and appropriate benchmarking;
- ix. Openness to change and evolution, so as to maximize the benefits that could be derived from the experience to be gradually gained in running actual IJPIs; and
- x. Low administration overheads by all categories of actors involved.

The success of the introduction of *IJPIs* in practice would depend on the existence of certain necessary “preconditions” of success which are primarily the following:

- o *Harmonisation of research “cultures” and governance regimes.* This has been already referred to, in the previous sections;
- o Finding a “neutral” Organisation that would - at an international level - monitor and provide guidelines for International Joint Programming initiatives. Such “neutral” Organisation could play the role of the Council of representatives (i.e. the ERAC-GPC) within the EU’s JPI practice. It is felt that at international level such “neutral Organisation” can be found in the frame of one of the United Nations Institutes or specialised Agencies (e.g. UNESCO, or UNDP, or even UN “Institutes”). Alternatively, some well developed regional or international NGOs could also be considered, either from existing ones - carefully scrutinised – or new ones like the suggested *Global Transport Research Alliance* mentioned in section C (Other recommendations) below. Finally, if and when the proposed in the previous sections *Conference on Global Research Cooperation (CGRC)* Organisation is set up and running, it could undertake this task too;
- o Establishing common themes of interest, challenges and priorities that would be solid enough to solicit support for joint funding;
- o Existence of human resources as well as “champion” Organisations in all parties involved, capable of handling the complex managerial and scientific tasks that will be necessary in order to have “balanced” participation in the *IJPIs*.

Given the difficulties and uncertainties inherent in an international multilateral joint programming initiative, we would suggest as a first step, with good opportunities for success, to try and establish one first International JPI involving the EU and 2 or 3 other countries. These countries could be found among those that already share with the EU common research ethics, and research structures. The following topics could potentially draw enough support for such first *IJPI*:

- I. *Sustainability of surface transport*, maybe limited to urban areas only (i.e. dealing with the issues of urban congestion, air pollution, clean cars use, and environmental traffic management);
- II. *Maritime transport* with emphasis on anti-pollution and safety and security issues;
- III. *Climate change*: transport related adaptation and mitigation measures.

A simplified type of funding scheme must be evaluated and adopted for such international cooperation initiatives. Such type of funding rules could be

similar to those used in the *Competitiveness and Innovation Framework (CIP)*, EU funded projects. Such funding scheme would have features like:

- Fixed rates based on the duration of the project and number of partners;
- Personnel cost acknowledged to the coordinator only, for reporting and for organising meetings;
- Other partners only receive fixed Lump Sums for general expenses;
- Only the coordinator is required to submit a financial report.

This recommendation is made with the aim of significantly reducing the administrative burden to the international participants, thus enabling these partners to focus on the real contents of a project rather than spending disproportionate resources on administrative and financial reporting tasks which is often quite impossible to do for international partners.

7.3 Wider and more collaborative use of Research Infrastructures (RIs)

Enabling research Organisations to share their research infrastructures (hard or soft) and other facilities is of paramount importance, especially if this sharing and cooperation is also made between international Organisations with similar facilities. Through such cooperation (i.e. between international organisations with complementary facilities) as well as between major research Organisations, research infrastructures and resources would be utilised more optimally and this will benefit the research community by the creation of a cost-effective and diverse pool of research resources capable of stimulating more innovation.

Furthermore, the need for the creation of new world-class research infrastructures (RI) to address common future challenges in the transport sector must be addressed. So far major transport research infrastructures have been mostly created in a fairly fragmented way, in line with available National budgets and policies and usually have limited impact outside the country where the investment was undertaken. It is therefore of increased importance to the fostering of more international cooperation and collaboration to promote, with specific measures and actions, an environment (legal, financial, administrative) that can bring together different RIs, their capabilities, and the corresponding competences of the owning Institutions.

The findings from current examples on shared RI and the feedback received from Organisations and researchers that were interviewed, point towards a roadmap for RI cooperation comprising five levels as shown in Figure 5 below⁸.



Figure 5: Levels of networking around RIs

As regards **Level 1** (*Explanation of need and benefits of cooperation around RIs*), the very first step towards establishing cooperation around RIs is to explain the needs for and the benefits of RI cooperation. This may sound simple, but before organisations are able to identify the potential for cooperation around RIs, they have to be convinced of its necessity. The following actions are recommended:

- Increase experience by participation in international projects and networks of excellence, and/or become members of umbrella organisations;
- Allocate funding to contribute to the cost of participation;
- Raise interest by presenting positive examples and highlight their benefits.

The experience gained through these actions will form the basis for possible future cooperation around RIs.

As regards **Level 2** (*Sourcing of partners through database searches*), this is aimed at creating awareness of the existence of world-class RIs in the international research community in order to foster possible cooperation. A possible way of raising awareness is through the development of an RI database containing world-class RI addressing all transport modes, e.g. by further developing the FEHRL RI Online Catalogue, and rendering this database accessible to the research community. The more RIs are listed in this database, the greater its value will be.

As regards **Level 3** (*Establishing networks around special research topics*) this involves initiating formal cooperation, and building a climate of trust and

⁸ Originally developed in the DETRA project, but refined and substantiated further in the EUTRAIN project.

understanding between Organisations and researchers in order to facilitate the sharing of information, knowledge and experience. Only in such a climate will, sharing of results between partners, be possible. The goal to be reached at this level would be the creation of a **pool of expertise founded on mutual trust**. There are no tools that can force the creation of trust, but by becoming more familiar with other organisations than their researchers and by working together on projects, the level of trust will certainly improve. If potential partners are not willing to invest time and money for the creation of such networks (pools of expertise), it can be assumed that they have not (yet) reached the final stage of Level 1 with respect to cooperation on RIs. In this case, it will be necessary to revert back to a lower stage in the “Levels of networking” of Figure 5.

As regards Level 4 (*Sharing knowledge and experience*), the aim is the further development of existing methods (and their validation through round-robin testing) and the exchange of knowledge and experience by the exchange of staff or by having joint workshops / seminars / courses.

As regards **Level 5** (*Collaboration through common RIs*), this comprises the establishment of **common projects around at least one RI**, where the RI forms an essential basis and common resource for a project. Collaboration is founded on formal agreements between the partners in which the responsibility of each partner is clearly defined. The aim is to create, develop and/or deploy RIs using the best available expertise and knowledge from each partner. Usually, the RI will be located in the country of one of the partners. This means that on the one hand this partner will have a benefit because of the local presence of this infrastructure, but on the other hand he will also have to carry the responsibility (and costs) for the maintenance and management of the RI on behalf of all partners. A number of obstacles and barriers concerning collaboration on Level 5 were identified as follows:

- Legal barriers, including insurance issues⁹ (usually there is no or limited insurance cover for government-owned RIs);
- Intellectual property regimes (IPR) are often a hurdle for transferring the outcomes;
- Additional costs for partners (e.g. for travelling and insurance);
- Physical condition of RI due to financial constraints;

⁹ To overcome the barrier of insurances, it is possible to manage and operate the RI with assistance from the owners of the RI. If possible, e.g. if the RI is mobile, the transfer of RI to another country with fewer restrictive legal barriers could be considered to overcome legal constraints.

- Difficulties experienced with international transfer of funding.

Collaboration based on some sort of bilateral exchanges of RI usage, has been the most common form of RI collaboration in the past. Generally, an exactly balanced exchange between collaborating partners is seldom achieved, but this should not be the aim of the collaboration effort. The aim should be to link the best expertise, experience and knowledge of the partners with the best hard and soft infrastructure at their disposal to achieve the desired outcomes of the RDI programme. Good collaboration between partner organisations and their researchers should stimulate the discovery and implementation of more efficient and effective RDI approaches, based on cross-pollination of each partner's expertise and experience, resulting in collective gain providing benefits to each partner.

It is also recommended that an **International RI Task Force for all transport modes** be established to formulate recommendations and promote actions for networking and for information and knowledge exchange on world-class RIs, and to identify requirements for new RIs linked to the Grand Challenges in particular. Research organisations that have already acquired good experience on the above, should share their know-how and should be invited to participate in the International RI Task Force. If the conditions are ripe as per above statement, this RI Task Force should create a Working Group on RIs (WGRI). This Working Group should have as its purpose to investigate the issues and instigate coordinated actions for the development of new RIs. The WGRI should provide recommendations on the selection of which RIs to promote by priority and submit those to the RI Task Force. In the main EUTRAIN report the particular tasks of this WGRI are also given.

It is finally, imperative that large, critically important transport-related RIs be incorporated in the short term future in the *European Strategy Forum on Research Infrastructures (ESFRI)* roadmaps (transport-related RIs do not feature in current roadmaps).

On the whole subject of RI cooperation in the transport field Organisations such as: The *Conference of European Directors of Roads (CEDR)*, the *European Transport Research Alliance (ETRA)* and possibly other stakeholders such as universities, etc, should initiate a dialogue on the need for new, major transport-related RIs and their inclusion in the ESFRI roadmap. The first step should be to identify the national needs and to ensure that transport-related RI features on national roadmaps. Also the national representatives on ESFRI should be involved. Once the needs for new transport RIs have been articulated, the next step would be the drafting of ESFRI proposals for transport-related RI and the subsequent endorsement of these proposals by a

delegation of national experts which has the task to submitting this draft to ESFRI. Upon approval by the ESFRI Executive Board that the proposal can be subjected to the ESFRI review process, the above mentioned Working Group would then take this process further. If the outcomes are found to be positive, the identified RIs could then be listed in the ESFRI roadmap, which will greatly assist towards the implementation of the specific “common” RI.

7.4 Improving human resource capital for transport research through training, and education and researcher exchange programmes

The need for systematically improving the human capital that is involved in transport research, especially in terms of its involvement in international cooperation projects, is quite self-evident. A number of recommendations have been generated for training and human resource issues the most eminent of which, as well as the most practical, are presented below.

1. Systematic web training of transport researchers (with emphasis on international cooperative work) based primarily on the use of on-line (remote) education tools like webinars or other internet based tools. This form of training has the advantage of not requiring physical presence, and thus it creates the least disruption to the professional obligations of the trainees. Such online educational tools would help transport researchers from around the world increase their skills and would also help develop researcher networks and help foster future collaborations.
2. Organisation of Short courses and training workshops. With some relatively moderate funding for visiting lecturers and for the participation of the trainees, special “training” workshops can be organised to provide participants with state-of-the-art case studies, or new knowledge and know-how on specific subjects. They, too, can be helpful sources of networking and collaboration for transport researchers across the globe. The European experience of the ECTRI/FERSI/FEHRL co-organised bi-annual *Young Researchers Seminar (YRS)* can be used as a guide here.
3. Researcher exchange programmes. The mobility of researchers is a key instrument of international cooperation that should be integrated in the Commission’s strategy for international Science, Technology, and

Innovation cooperation. Marie Curie Actions and ERC grants contribute to Europe's attractiveness and international cooperation status and this should be intensified in Horizon 2020. Framework conditions for incoming and outgoing mobility should be improved and simplified. We recommend particular attention to the following aspects:

- a. Help with funding of the supervisory aspects of the hosting institutions in European funded researcher exchange programmes. Without funding support many research organisations without national government support find supporting researchers from other organisations to be significantly burdened by additional costs, making it unlikely that they will support these initiatives.
 - b. Increase the allowable percentage of commercial work that an EU supported researcher can undertake for the institution they are working for. This will bring commercial experience and skills for the individual and help with managing institutional costs especially those organisations with no Government funding.
 - c. "Structured mentoring" should be considered as suitable for funding under researcher exchange schemes.
 - d. Consider increased incentives for providing highly skilled researchers to developing research organisations by stronger and more "recognised" European research institutions.
4. Creation of a Researcher Database. This would provide data and CVs of suitable researchers for organisations looking for such skills and vice versa (i.e. potentially offering skilled researchers). Such database is being developed already through EU funded project HERMES (concurrent to EUTRAIN) and will be sustained for a number of years in its web address: <http://www.hermes-project.net/>. In addition, or as a future development, this database could be attached to a new "Skilled travel and Transport Researcher section" in the EU website.

The Researcher database should cover:

- Information on institutional benefits or collaboration and temporary secondments of transport staff in the EU and Internationally.
- Information on the current financial incentives to organisations and individuals of collaborating by relocating to other research organisations.
- A database of requests of organisations looking for temporary secondments to improve skills or for individuals/organisations offering skills for secondment.

A further possibility could be the use of the services of the various National Science Academies in order to explore the role that they can play in promoting south-south and north-south mobility of transport and travel researchers¹⁰.

7.5 Harmonizing governance and research institutional cultures at global level

One of the main – but long term - areas in which progress must be made in order to facilitate and enhance international cooperation activities, is the need to harmonize (as much as possible) the prevailing institutional “cultures” and research governance regimes in all cooperating countries. Already the recommendation in (B) above for the creation of the *International Cooperation Promotion and Networking Centres* - ICPNCs will go quite some way along the lines of promoting harmonization of research “cultures” across the globe, because the activities of such Centers will also promote such harmonization.

The long term harmonization of research governances however, will need to go through a number of stages and will take time to conclude. These “stages” can broadly be defined as follows:

1. Further investigation of the problems and issues involved;
2. Development of a long term vision of how to organize and manage global (transport) research through the benchmarking and other actions suggested earlier;
3. Foster consensus for this new vision and gather competence to enact it and achieve cohesion to move it along globally.
4. Establish some “revitalized” cooperation frameworks with the countries of interest avoiding to adopt a scheme in which “funding” countries are “imposing” their views on “recipient” or “lesser research oriented” ones.
5. Institutionalize this revitalization through formal research agreements introducing the new policies, systems, and research structures.
6. Monitor and adjust strategies in response to problems in the process of harmonization.

¹⁰ G-Science Academies Statements 2013, see: http://www.leopoldina.org/uploads/tx_leopublication/2013_G8_Statement_Driving_Sustainable_Development.pdf

In order to compliment the above frame or process it is recommended that specific **benchmarks for international transport research cooperation** are established and gradually implemented through a number of concerted actions. The prime objective of this “benchmarking action” will be to promote “harmonisation” in international research governance, management (including evaluation), and funding regimes so that there is more coherence and ease of cooperation among the involved governmental and other entities.

The areas in which “Benchmarking” in this sense needs to be promoted are:

- a. *Formulation of basic rules and guidelines for calls and evaluation of proposals;*
- b. *Procedures for selecting topics and formulating work programmes;*
- c. *Organisational schemas and lean governance structures for research in general and transport research in particular;*
- d. *Monitoring indicators of international cooperative (transport) research actions.*

In order to take up this issue of “benchmark setting” but perhaps more importantly their promotion and wider acceptance i.e. promoting harmonization of research governances and “cultures” across the globe, we recommend that these actions – after perhaps an initiating and facilitating study by the promoting governments – are undertaken by an independent global strategic Organisation, that can be entrusted with this task, either from existing appropriate Organisations (such as e.g. one of the UN educational and research related Institutes or Agencies), or by a new Organisation to be created by a common action off the interested governments: the ***Conference on Global Research Cooperation (CGRC)***¹¹. Such Organisation could be created to act as the body that promotes more harmonised research governance across the globe. It will have to be established through

¹¹ Of relevance here is also the proposal made by the DETRA project for the creation at global level of a ***Global Transport Research Alliance*** Organisation (i.e. a more loose and flexible, partnership type of Organisation like the *European Transport Research Alliance – ETRA*) which would have as its main aim the promotion of International Cooperation in the field of Transport. This *Global Transport Research Alliance* could assume the format of a collaborative platform between major international Associations or other organisations representing Transport research and aimed at mobilising their members towards international cooperative actions to address the Grand Challenges in transport across all modes through innovation and the adoption of multiple-disciplinary approaches. The goal should be to yield collective impact at an international level, as well as transferable outcomes for deployment at regional and national level.

open and voluntary participation of the countries that are interested in promoting international research cooperation on the initiative of the EU, the US, or other interested governments.

7.6 Promoting pre-standardisation and market uptake of research results

Currently, many R&D projects have activities related to standardisation, often as part of the *Dissemination and Exploitation* section of their activities. Some of them carried out gap analysis to identify needs for standardisation, including needs for international cooperation in standardisation. Many R&D projects give recommendations to future standardisation activities (often involved with international cooperation) in their exploitation plans. However, few of such recommendations have had real impacts on the future work since there is no resource to support such activities beyond a project's lifecycle.

It has been recommended by many stakeholders from both industry and research Organisations that the EC's financial support to international standardisation activities are essential, taking into account that the current economic situation does not allow industry to invest much into international standardisation. The current practice to support standardisation through coordination and support actions projects has been acknowledged as an efficient way, but the dissemination activities could well be significantly reduced. It has even been proposed that such projects may not include general dissemination activities at all, in order to focus primarily on standardisation activities. They should be carried out by key industry players, with participation also of major research Organisations. To be eligible to participate in such projects, pre-agreements with standardisation organisations and international partners should be required. Partners of such projects should be experienced in international standardisations and ideally have been members of relevant working groups or of standardisation organisations.

As an overall conclusion we can say that in developing the framework conditions for future international cooperation in research and innovation we must implicitly pay attention to promoting adequate systems of *Intellectual Property Rights (IPR)* protection in international collaboration and of the use of public procurement to stimulate the demand for innovation. A number of third countries and international organisations such as the OECD or UNESCO have undertaken similar discussions.

The EU should do more to promote the uptake of the outcome of these discussions, both internally and in its international cooperation activities.

Priorities and future policies in these issues should be set through deciding:

- a. For which of the aspects of international cooperation mentioned above (e.g. IPR, public procurement but also of wider issues such as: ethics, societal engagement, open access, gender) would it be important to develop global “standards” in international cooperation?
- b. How can these standards be best promoted at the international level? Should they be included in the EU's S&T cooperation agreements with third countries?
- c. Should these standards have an implication on the way in which the EU provides funding to third country participants through Horizon 2020?

7.7 Other related recommendations

All larger EU research based projects should have an expectation of some type of international co-operation built into them. This would increase international research collaboration proposals and some sort of actions to make world markets aware of the research capabilities and skills within the EU which may develop into commercial collaborations that will benefit both the EU and other countries.

In the context of Horizon 2020, and as regards the international cooperation components of projects, it is proposed to differentiate through three major country groupings:

- the industrialized and emerging economies;
- the enlargement and neighbourhood countries; and
- the developing countries.

This typology, for each of these groupings, will steer the focus of the cooperation activities. For the industrialized and emerging economies the principal concern will be of avoiding competitiveness issues, but complementing each other and creating synergies to increase the potential of both sides. For the enlargement and neighbourhood countries, a rationale of integrating into, or aligning with, ERA and taking advantage of proximity is more applicable. Finally, for the developing countries, external and development policies are likely to be the key drivers, but also increasingly market developments, sustainability concerns and responsible governance.

The key policy issues here, to which the Commission must give its (policy related) answers, are:

- ✓ Where is the balance between cooperation and competition in international cooperation and at what point does safeguarding the interests of Europe's companies prevail over the advantages of cooperation?
- ✓ Should a strengthened innovation dimension be systematically built into the Union's international cooperation activities or should it only be addressed with particular countries and/or regions and on a case by case basis?
- ✓ Should the innovation dimension of international cooperation activities be restricted to discussions at policy level (e.g. sharing of experience or identification of good practice) or should it go as far as jointly developing close-to-the-market activities?

7.8 Recommended action list

Of all the above proposed actions and activities, which concern several stakeholders the following are singled out as concerning primarily the European Commission and can be initiated and promoted by its services in the immediate future:

1. Create – through assignment of one facilitation project in the H2020 programme – of the specifications, basic characteristics, and blueprints for implementation of the recommended:
 - a. ***International Transport Research Cooperation “Observatory”-IRCO***, which would also undertake the **benchmarking activities** for international transport research cooperation, and
 - b. ***International Cooperation Promotion and Networking Centres – ICPNCs***.
2. Proceed to bilateral and multilateral coordinated agreements with as many governments as possible, that will aim to create consensus on supporting future common international collaborative actions in the following areas :
 - a. Further investigation of the problems and issues involved in international cooperation;
 - b. Development of a long term vision of how to organize and manage international cooperation in (transport) research through the benchmarking and other actions suggested earlier;
 - c. Foster consensus for this new vision and gather competence to enact it and achieve cohesion to move it along globally.

3. As an ultimate step of the above process of intergovernmental contacts and common actions try to:
 - a. Establish some “revitalized” formal research agreements with agreeable governments introducing the new policies, systems, and research structures for international cooperative projects.
 - b. Monitor and adjust strategies in response to problems in the process of harmonization.
 - c. Create, and confide on, a **Conference on Global Research Cooperation (CGRC)** the task of continuous promotion of harmonised research governance across the globe.
4. Coordinate with at least one more government outside Europe that shares this common framework proposal, in order to co-fund at least one **International Joint Programming Initiative (IJPI)**. The conditions of success as well as the main steps to follow in this process are described in detail in the previous sections of this report.
5. Facilitate the creation or the continuation and support of existing “soft” actions that promote the enhancement of human resources in the field of Transport research. This action involves several actions, as follows:
 - a. Support the enhancement and maintenance of existing researcher data bases in the field of transport as per our more detailed suggestions above.
 - b. Facilitate and support researcher exchanges and the holding of short courses or training workshops.
 - c. Facilitate and support the creation and use of web based on-line “virtual” training courses in the form of webinars.
6. Support the continuation of the work that started, on the initiative of certain stakeholders, on listing major research infrastructures in the field of transport.
7. Support initiatives of relevant stakeholders for the inclusion of new transport research infrastructures in the **European Strategy Forum on Research Infrastructures (ESFRI)** roadmaps.

8 REFERENCES

Beer, M., Eisenstat, R.A., Spector, B. (1990). Why change programs don't produce change. *Harvard Business Review* 68 (6), pp. 158-166.

COMMISSION OF THE EUROPEAN COMMUNITIES (2008). "A STRATEGIC EUROPEAN FRAMEWORK FOR INTERNATIONAL SCIENCE AND TECHNOLOGY COOPERATION"; available: http://ec.europa.eu/research/press/2008/pdf/com_2008_588_en.pdf

DETRA (2010). Deliverable D2.2 Research Infrastructure – needs and requirement, available at: http://detra.fehrl.org/index.php?m=3&id_directory=6825

DETRA (2010). Deliverable D3.2/3.3: Final recommendations to foster ERA deepening, available at: http://detra.fehrl.org/index.php?m=3&id_directory=6825

European Commission (2008). Guide to Intellectual Property Rules for FP7 projects, available at ECTRI, 2009, European – United States Transportation Research: Challenges & Opportunities, available at <http://www.ectri.org>

ERAC Knowledge Transfer Group (2012). European Research Area Guidelines on Intellectual Property (IP) Management in International Research Collaboration Agreements between European and Non-European Partners

ETRA (2012). Activity Plan for 2013-2016, available at <http://www.pavementinteractive.org/article/hvsia-2/#sthash.iXFEha29.dpuf>

ETRA (2013). Statement of Purpose and Vision, available at <http://www.etralliance.eu/>

European Strategy Forum on Research Infrastructures (ESFRI) (2011). Strategy Report on Research Infrastructures – Roadmap 2010, European Union, available at: http://ec.europa.eu/research/infrastructures/pdf/esfri-strategy_report_and_roadmap.pdf

EUTRAIN (2012). Deliverable D2.1: "Current Practices, Characteristics and Issues in Research Collaboration", available at: www.eutrain-project.eu

EUTRAIN (2013). Deliverable D3.1: "Research Topics, Capabilities, and Future Priorities for International Transport Research cooperation", available at: www.eutrain-project.eu

FHWA (1997). Innovative Contracting Practices for ITS, available at: <http://www.fhwa.dot.gov/publications/research/operations/its/pdfs/contpractices.pdf>

FHWA (2009). Transportation Research Program Administration in Europe and Asia, available at: <http://international.fhwa.dot.gov/pubs/pl09015/index.cfm>

Jacobs, A. H. M. (2012). A critical-hermeneutical inquiry of institutional culture in higher education. PhD Dissertation, Stellenbosch University, Western Cape, South Africa.