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DECOMOBIL Report on Joint Research Initiative. Deliverable 7.2

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Abbreviations

Abbreviation	Meaning
JRI	Joint Research Initiative
JPA	Joint Programme of Activities
FP6	Sixth Framework Programme for Research and Development
K	Knowledge
KIC	Knowledge and Innovation Communities
EIT	European Initiative for Technology
PCDA	Plan, Do, Check, Act
ETP	European Technology Platform
DECOMOBIL	Support action to contribute to the preparation of future Community research programme in user centred Design for ECO-multimodal MOBILity
HUMANIST	HUMAN centred design for Information Society Technology
DETRA	Developing EuropeanTransport Research Area
SETIS	JRC SETPlan Information Service
SETPlan	Strategic Energy Technology Plan
STTPlan	Strategic Transport Technology Plan
CSFRI	Common Strategic Framework for Research and Innovation
JRC	Joint Research Centre
ECTRI	European Conference of Transport Research Institutes
TRB	Transportation Research Board
EARPA	European Automotive Research Partners Association
NOE	Network of Excellence
ITN	Initial Training Network
VCE	Virtual Centre of Excellence
KET	Key Enabling Technologies

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Jiatong	Dedicated Chinese University to transport and communication
BP	Business Plan
BPIS	Business Plan Integration and Sustainability
Idea League	Forum of European Universities and Technical Universities of Excellence

Executive summary

In the frame of the FP7 DECOMOBIL – DG CONNECT project, this deliverable summarizes the two tasks of the so-called WP7 “Reflection on the concept, the performance indicators of an eventual Joint Research Initiative”: 1/ definition of the JRIs and how to be operational in FP8, 2/definition of a framework of JRIs business plan principles and indicators.

It delivers also two concrete examples of eventual JRIs based on the HUMANIST VCE.

The first deliverable has been discussed through also the FP7 DETRA (Developing European Transport Research Area) DG RTD project as part of its WP3 on reinforcing the research institutions (universities and research organizations) and some ideas are cited for all transport retained subjects in the last deliverable DETRA WP5 D5.2 on programmes.

Therefore this deliverable is useful not only for ICT for transport related issues but also for transport related issues of next Horizon 2020.

The idea of JRI is linked to the reinforcement of the supply side of the European Research Area for transport and ICT for transport.

It is taking into account the fact that innovation is not necessary any more linear.

It is based on the Lund and Debrecen Declarations as well as the Polish and Danish Presidencies for transport research and ICT for transport research. In this domain the Lyon and Brno Declarations were of full support.

It is also taking into account that the full landscape of research and innovation from the idea to the uptake market needs various types of research.

The iMobility Forum adopts the Knowledge & Innovation Diamond Diagram to explain it, and many transport industries consider it as sufficiently explanatory.

The JRI is a 7-years integrated cooperative project organized in two Joint Programmes of Activities.

The full layout of the scientific activities and the integration of the JRI are explained in the report.

The 2 JPAs articulation in addition to the governance and the general and daily management are also described.

An assessment methodology of the JPA outcomes related to each type of activities is detailed, including the process assessment through evolutionary and relevance indicators.

The evaluation of the cost is based on examples linked to DETRA and DECOMOBIL projects ideas of JRIs following the table in part 6.7 of this document.

In conclusion, the DECOMOBIL partners are thinking that the JRI concept as described in this deliverable is useful and feasible at least in the scientific domains of ICT for transport and transport related issues. The objectives of the Lisbon Treaties related research shall be tackled through the implementation of ERA and through a strong scientific participation based on competitiveness and policy making.

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1. Introduction

1.1 Why preparing a JRI feasibility frame and recommendations

HUMANIST VCE and other organizations, Signatories of the Lyon Declaration, have made some proposals for the establishment of specific research and innovation program, the so-called "Focused Joint Research Initiative (JRI)". This type of program is supplementary to academia-industry and industry-industry research and innovation partnerships, sustaining European Research Alliances in their generations of new project or program ideas.

The JRI is in line with the Lyon (2009), Lund (2010) and Debrecen (2011) declarations to reinforce networked research institutions in order to promote excellence, research relevance and 21st century governance in Europe, and in line with the propositions of the European Court of Auditors and the DG Budget audit reports on Networks of Excellence future.

While the Knowledge and Innovation Communities (KICs) are dedicated to a network of nodes covering the full Knowledge Triangle (see figure 1), the JRI aims at transforming frontier or anticipatory research into relevant focused scientific knowledge. Reinforcing research organizations within an institutional and thematic network through this specific instrument will allow accelerations and/or transformation of the innovation path. This new type of program proposes measures promoting interactions with various stakeholders with the purpose to improve relevance of thematic scientific programs.

This scientific initiative could be very fruitful as harmonized prerequisites for standardization, interoperability and for the making of policies and regulation. This process could also allow strengthening customer-oriented research for worldwide attractiveness, competitiveness and integration of Europe, with the aim of excellent governance around horizontal activities.

The Work Package 7 of DECOMOBIL aims at having a reflection on the concept of JRIs and produces a set of recommendations that could support the implementation of this new instrument.

Therefore, we need a proof of the concept and generic recommendations to be operational and successful in the field of transport and ICT for transport in a first step.

In a second step, we will present concretely what could be the content of a JRI around the human factor engineering for smart, intelligent, efficient transport and mobility especially in ICT for transport.

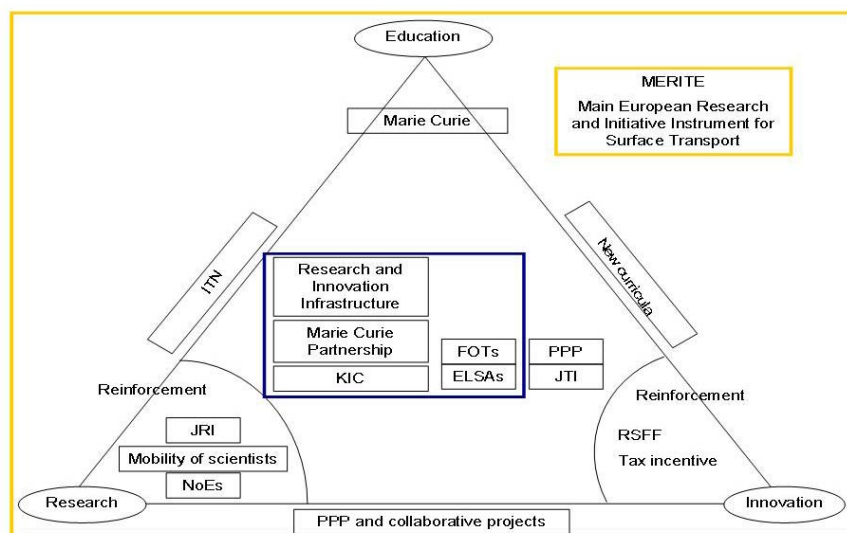


Figure 1. The Knowledge Triangle and the JRI positioning

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1.2 The scope of the JRI Work Package

The scope of this Work Package is to present the concept of Joint Research Initiative, to propose recommendations for its operational implementation and for its performance assessment and to identify potential Joint Research Initiative in the domain of DECOMOBIL / HUMANIST.

The first step concerns the refinement of the JRI concept, its operationality and its feasibility in the follow-up of the Lyon Declaration Signatories Task Force deliverable A (November 2009) and the two DETRA documents (November 2010) called "Memorandum on Focused Joint Research Initiatives" and "The Next Generation of European Research and Innovation Deployments".

The second consists in the definition of a framework for JRIs business plan principles and performance indicators illustrated by the case of a potential JRI following DECOMOBIL/HUMANIST project.

1.3 The scope of this deliverable

So this deliverable is the document ending task 7.1 and 7.2 of the WP7 of the description of work: "Definition of the JRIs and how to be operational and feasible within the CSFRI 2014-2020".

The aim of these 2 tasks is to set up a feasibility framework regarding the modalities of JRIs implementation. General issues and indications on JRIs Joint Program Activities could be set and propose in the frame of these tasks.

This JRI instrument is dedicated to the reinforcement of networked research organizations around relevant themes for policy support, for economical development, including explanatory research or research concepts.

So, the partnership should be made with volunteer research organizations, deciding to network with the aim to enhance their excellence and relevance at European and international levels.

The search of excellence requires having two types of advisors to the JRI network:

- International peer review scientists from academia or industry research centers
- Industry including SME, stakeholders and eventually policy makers' stakeholders

The final customer of the produced research shall be industry research centers, spin offs, and/or policy makers or evaluators, besides the integration of the network.

The expected outcomes of the JRI concern Integration and governance, Education and training, Scientific thematic activities including innovative ones, Dissemination and stakeholders interaction.

This deliverable is made in a generic perspective for the deployment of such JRIs in the domain of transport and ICT for transport, and could be used for:

- DECOMOBIL follow up
- DETRA (Developing a European Transport Research Alliance) follow up
- eventually by EREA members besides the other Lyon Declaration Signatories members.

2. Generic description of a JRI: who, what, for whom, how?

2.1 Introduction

The Lund Declaration taken within the ERA Vision 2020 approval is asking to foster:

- Mobility of researchers
- Training and education
- World class European research infrastructure
- and to reinforce research institutions.

The Debrecen Declaration reinforces the need for world class European research and innovation infrastructure.

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The open innovation model and the non linear innovation schemes are requesting this reinforcement of research institutions: this to maintain good partnership with industry and to promote start ups in an innovation ecosystem.

Traditional Linear Scheme of Innovation

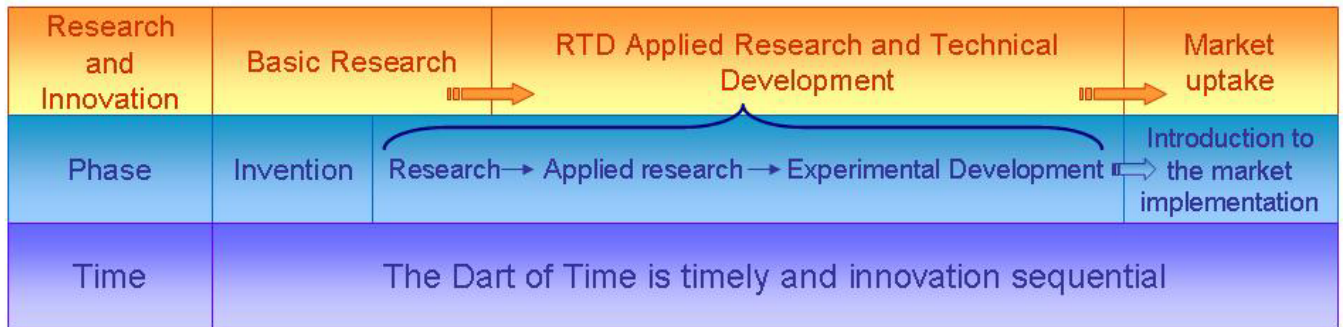


Figure 2. Linear scheme of innovation

New innovation schemes including non linear schemes

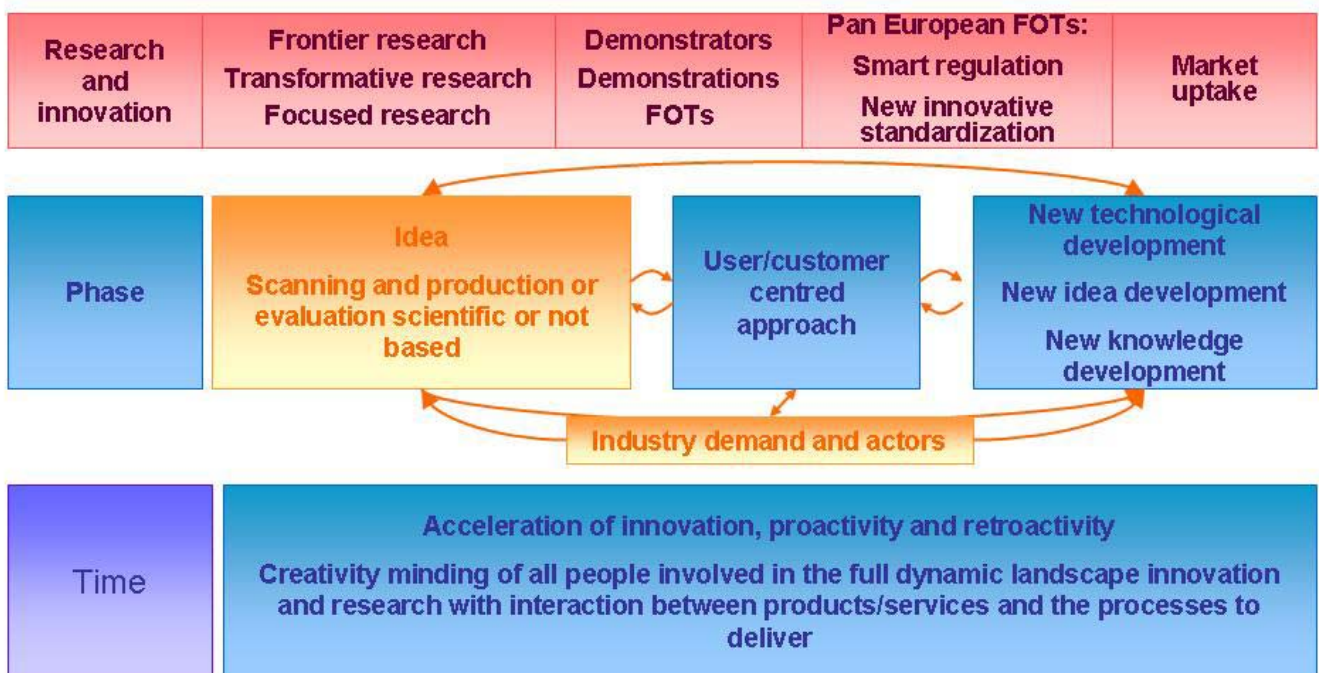


Figure 3. Non linear scheme of innovation

The global dimension of innovation and the European competitiveness and competition draw to have scientific based evidences, where production is well governed and relevant to innovation.

All these issues conduct to have a specific initiative adapted to the research corner of the Knowledge Triangle and promoting excellence, relevance and 21st century governance.

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While the KICs are dedicated to a network of nodes covering the full Knowledge Triangle, this specific initiative tackles with the transformation of frontier research or anticipatory research into relevant focused scientific knowledge and while reinforcing research organizations within an institutional and thematic network, is aimed at cross cutting the innovation path by acceleration or transformation.

In some cases, these scientific evidences could be very fruitful as harmonized prerequisites for standardization, interoperability, policy or evaluation making or regulation or rule making.

In any case, these evidences and the orientations of the network have to be created in a stakeholders' interactions, made or not through adequate forum formats.

So, this document develops the idea of a specific type of initiative - called by the Lyon Declaration Signatories Task Force Deliverable A December 2009 - Focused Joint Research Initiative (JRI), supplementary to academia-industry and industry-industry research and innovation partnerships, sustaining European Research Alliances in their generations of new ideas or project ideas or program ideas including the idea of a European Transport Research Alliance.

This shall be illustrated by surface transport related research domains (transport per se, materials, energy, ICT, environment,...) and included in dedicated technology plans, such as SET Plan or STT Plan.

2.2 Why

As the Lyon Declaration gives an overview on the ERA 2020 Vision for the surface transport related research domain, many of the recommendations of this report are developments of this Declaration of the key research bodies.

The transport related research and ICT for transport domains is based on focused research encouraging new frontier research developments and its translation into scientific knowledge in a form useful for the different stakeholders according to their individual time frames or strategic requirements. This process is of considerable strategic importance when the Grand Challenges demand an acceleration in the pace of innovation (both incremental and breakthrough) and implementation.

On ERA development, surface transport research needs a major development of the Fifth EU Freedom, ie:

World-class European research infrastructures are critical for the transport sector, not only aimed at opening new frontier knowledge but also at preparing the answer to the political and/or societal challenges and address competitiveness issues.

The types of investments here include new hard research infrastructures addressing issues such as climate change adaptation but also new soft research infrastructures, particularly there is a need for new data bases from demonstrations, FOTs or scientifically adapted to the new challenges.

The reinforcement of the research institutions and their transnational, institutional or scientific networks in the frame of the Knowledge Triangle or for the need of innovation is highly critical: it is not only relevant for the research institutions but also to avoid detrimental effects on other stakeholders. Scientific knowledge and the information society must be strengthened by increasing the attractiveness of EU for World-class R&D centres. The key aim in this respect is raising (scientific) Excellence, Relevance and Governance and promoting good interaction between frontier and focused research.

International cooperation, on the models prepared by some European projects or the so called ECTRI-TRB report, has to be reinforced in order to address the ERA challenges globally. Practical examples of research benefits could arise through greater harmonization of data and knowledge useful for standardization and policy making, through mutual understanding and recognition of scientific excellence as well as direct research cooperation through the key areas addressed above: mobility, training and research infrastructures all have international dimensions. This effort will be aimed at improving the international interfacing of European surface transport research excellence.

Tackling the new Grand Challenges where transport is a part of the problem and a part of the solution is of overarching importance.

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The needs for “new simple initiative” will largely be driven by the implementation processes. This case will be particularly representative of the transport research dealing with the accelerated pace of innovation associated with the new scientific knowledge needs (ICT or low carbon) and the Grand Challenges. This will create the need to have the following instruments:

- 1) The Lund Declaration has generalized the Lyon Declaration to the European research and innovation system.
- 2) "EU/US Transport Research Collaboration: Challenges and opportunities"- February 2009.

The need to promote the development of scientific knowledge and for international excellence in Europe (including relevance and governance) generates a greater need for Focused Joint Research Initiatives. This type of initiative is aimed at the international excellence and reinforcement of European research organizations and their European networks would tackle and accelerate the creation of scientific knowledge and is focused on one corner of the Knowledge Triangle.

These projects shall be consist of focus oriented research, freely developed partially and developed under calls aimed at developing focused and scientific knowledge that could be useful in the future for different stakeholders with a variety of models of scientific development:

- Taking new frontier research outcome and transforming it for the transport scientific community of stakeholders without time frame.
- Working on the excellence of each partner and of the European network (scientific global and smart specialization).
- Anticipating and addressing the needs for standardization (because of the time lag).
- Disseminating to the stakeholders or by spin-offs including industry, operation, policy makers and citizen/society.
- Or creating new scientific based soft research and innovation infrastructures useful for all the stakeholders at intermediate, medium or long term, or managing new hard research infrastructure at European and/or International level as appropriate.

The overall aims of these initiatives are organizing both the international excellence of European research operators as well as preparing the strategic scientific knowledge of tomorrow and the future models in a synergetic way of some existing Associations, the previous NoEs, ITNs or some elements of the KICs. The concept could be described as a research organization consortium conducting the program with a strong platform of oversight (from stakeholders, scientists, etc) exchange, dissemination with other stakeholders and a platform for spin-offs creation.

To foster the innovative step-change characteristic of R&D there is a need to supplement by preparatory research through funding at full cost lead by academia/research institutions with road maps defined by relevant stakeholders. The final client of the spin offs produced research shall be industry research centers, and/or policy makers or evaluators, besides the integration of the network.

The following Diamond diagram explains the positioning of each type of scientific knowledge evidence for the full cycle of innovation including the society/citizen-user-consumer interaction with the traditional triangle of research, industry, regulator-policy maker.

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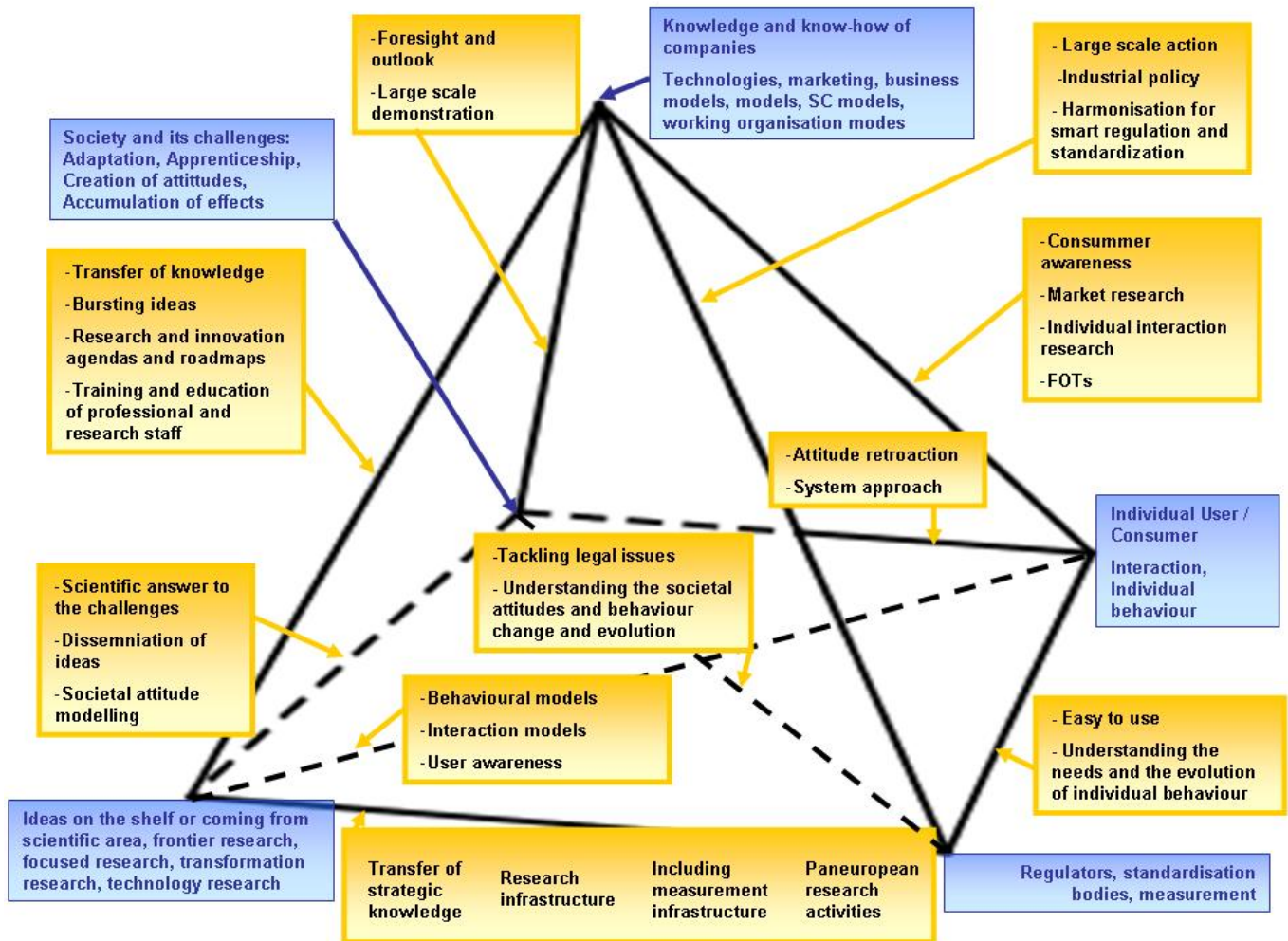


Figure 4. Diamond Diagram

2.3 Who and for whom

This type of initiative (JRI) is dedicated to the reinforcement of networked research organizations around relevant themes for policy support, of for economical development, including explanatory research or research concepts.

So the partnership should be made with volunteer research organizations, deciding to network to enhance their excellence and relevance at European and international levels from at least 3 Member States or 2 Member States + 1 Associated State and to integrate the researchers in a legible entity.

The research of excellence asks to have two types of advisors to the JRI network:

- International peer review scientists from academia or industry research centers.
- Industry including SME, stakeholders and eventually policy makers' stakeholders.

The final client of produced research shall be industry research centers, spin offs, and/or policy makers or evaluators, besides the integration of the network, and the interaction with society/citizen.

2.4 What

The Joint program Activities of the JRI shall be the following:

Integration and governance

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- Creation of an integration around a new concept of focused research organization for the 21st century.
- Development of the adequate new concept of governance.

Education and training

- Development of a new scientist's generation through mobility of post-doctorates, PhDs and joint selection of PhD and post-doctorates, and immersion of their work in the network of seniors.
- Development of training materials for professionals from:
 - o Industry or policy makers.
 - o Other users including society.

Scientific thematic activities

- Development of scientific activities based on a general theme, new approaches to cope with Grand Challenges that are scientifically consistent.
- Development of scientific activities based on the transformation of anticipatory, preparatory and frontier researches into focused researches useful for industry and policy makers.
- Development of scientific activities to create state of the art, new methodologies and concept of new measurement devices.
- Development of joint pan European research infrastructures definition, needed for cross-cutting innovation (data bases, knowledge bases, simulator, test beds, Pan-European harmonized equipment).
- Ethical and legal issues.

Dissemination and stakeholders interaction

- Joint edition policy and management
- Joint IPR policy and management
- Joint participation to WGs, conference
- Organization of stakeholder forums
- Creation of scientific advising groups

2.5 How

The manner to handle these JRIs is based on the manner of the successful FP6 NoE. Three are Lyon Declaration Signatories.

The duration shall be extended to 7 years.

There shall be two JPAs during the life of the JRI, chapter 3 is describing their details and articulation.

The overall planned grant shall be contracted.

Indicators of follow-up and of progress to integration have to be proposed in the contract.

The coordinated activities between the partners shall follow the Joint Programme methodology.

2.6 Conclusion

This new type of initiative JRI shall tackle primarily with the reinforcement of networked research organizations dealing with a relevant part of one or more Grand Challenges. It should be considered as supplementary to research and innovation academia-industry or industry-industry partnerships.

It can also include potential production of scientific evidence for standardization, interoperability, policy making or evaluation, or regulation.

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And it should be one international excellence locus where European industry R&D centres could find new adequate and dynamic scientific knowledge, and where generation of spin offs is on the move.

This could end by dedicated Pan European research organization basis for European research universities or for European Research Alliance.

3. Detailed description of the modalities for a JRI with transport domain or ICT for transport domain

3.1 Joint program of activities setting up and evolution

The Joint Program of Activities (JPA) is the collective vehicle for achieving the objectives and the consistency of the Joint Research Initiative.

The JPA should consist in a consistent set of new or reoriented activities that the JRI participants undertake commonly during the duration of the JRI:

- a joint program for mobility training and education for young scientists opened to young professionals,
- a joint program of research infrastructures used for research and innovation,
- a joint program of driven agenda executed research,
- a joint program of bursting or exploration of new scientific ideas including innovative scientific process activities,
- a set of activities to spread and disseminate the results and outcomes,
- a set of governance excellence issues including advanced research and innovation management integration of activities and strong stakeholder interactions and society interactions, through a:
 - o business plan
 - o battery of outcomes (open and closed access, knowledge management, contribution to open innovation and open access, observatory, scientific smart specialization at European and international levels, basis for guidelines, standards, policy or rule making and monitoring.

The promotion of gender equality and the compliance with ethical principles when relevant should be part of:

- performance indicators for outcomes, results,
- adequate events for stakeholders, including for society and the citizens.

It is suggested that the duration should be 7 years in alignment to the "CSFRI time frame", with a first Joint Program of Activities (JPA1) as detailed below, covering the 4 first years and a second (JPA2), covering the last three years and prepared during the third and fourth year of JPA1.

Each Joint Program Activity shall be detailed for the three first years except the bottom up activities described below - the fourth year if any should be detailed before the end of the year 2 of the current JPA.

The preparation of the second JPA shall be based on the global outcomes of the first three years of the first JPA and in any case shall consist in the same type of generic activities, but taking into account the acceleration of the scientific production and the experienced equilibrium between the driven agenda and the bursting idea agenda.

3.2 Mobility, training and education of young scientists

Taking into account the EC portal for scientific position exchange as well as the DETRA portal, the activities in favor of a young generation of scientists shall be based on the following issues and be minded to the scientists to serve universities, RTOs, industry research centers:

- Common recruitment of new PhD to cover each of the JPAs.
- Activities of training for JRI participants existing new scientists or doctorants, as well as the new doctorants in both JPAs.

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- Activities for new innovative doctoral and post-doctoral education and training prepared during the first 2 years of the first JPA and launched for the end of both JPA1 and JPA2, and opened also to industrials, doctorants or post-doctorants.
- This could also include the access to education and training for entrepreneurship made through European EIT KICs and program of post-doctorant exchange between the JRI participants.

3.3 Research and Innovation infrastructures

Based on the DETRA TREE, EREA and ECTRI deliverables, three types of activities shall be dealt with JRI world class and research and innovation infrastructures:

- Optimizing the existing facilities through support to their opening or access to the full JRI community, especially through the advanced best practice of use and sustain of a Pan European ecosystem of research and innovation facilities.
- This should be mainly conducted during JPA1.
- Support to the emergence of new Pan European research and innovation infrastructures. This should mainly be prepared during JPA1 years 3 and 4 and launched during JPA2 with other financial support than the JRI funding.
- Foster the potential for innovation of the existing and new research infrastructures (instrumentation, and ecosystem of research infrastructures). To be done during both JPAs.

These research infrastructures shall be consisting of:

- Physical facilities (hard research infrastructure) for observation, experimentation or simulation such as tracks, simulators, laboratories and instrumentation, field facilities including field operational tests.
- Soft research infrastructures:
 - o generic models,
 - o generic simulation,
 - o data bases and knowledge bases,
 - o observatories if any,
 - o libraries and literature data bases including virtual electronic ones.
- Innovative ecosystem infrastructures:
 - o Participation to SMEs or spin off support nodes.

3.4 Thematic scientific activities

The thematic scientific activities of the JRI shall be planned for the first JPA at last for the negotiation phase and therefore agenda driven.

During year 4 of JPA 1, after advice of the Advisory Board, and stakeholders interaction, shall be prepared the second wave of these thematic scientific activities (new ones, continuing or reoriented ones).

These activities shall be focused scientific activities along with all types of research, development activities linked with the innovation cycle, ie.:

- technology development,
- modeling, simulation tools development,
- methodologies development and enhancement,
- systemic approach,
- basic evidence for standard, rules of procedure, policy making and monitoring,

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- evaluation evidence production,
- development of research and innovation Pan European infrastructures,
- preparation, collection and treatment of laboratory or field demonstrations and large scale actions.

They shall be conducted by research teams belonging to specific task forces, working groups or poles from the JRI participants.

They shall be in charge to carry out the best practice analysis, research, and to report within and outside the JRI following the governance or dissemination on stakeholder interaction sub-chapters.

3.5 Innovative scientific process activities

These innovation scientific process activities are based on the models of:

- The OECD Oslo manual (non linear schemes and services research and innovation)
- The development of research and innovation and implementation interaction through demonstrators, field operational tests, large scale actions (simulation, observation, implementation) including methodologies.
- The frontier - focused research approach and the strong need for the acceleration of innovation and / or research processes.
- The KET exercise of Technology Readiness Levels enlarged to systems and / or other engineering sciences than the traditional European approach (NASA and NSF are considering there is a human factor engineering domain).

Besides the other scientific processes described in the other part of chapter 3, there shall be four types of activities:

- one stream of vision prospective and forecast research with continuously updated draft and two milestones at the end of both JPAs and made by an ad' hoc task force of scientists of the partners of the JRI;
- one stream of exploratory research activities planned bi yearly through the road map task force of the JRI and welcomed by the Advisory Board and the funding agencies; this exploratory research shall be tackling new emerging research ideas for the technology advanced knowledge, the systems or the organizations of the implementation. Therefore it shall be aimed at the following issues:
 - o scientific concept formulation,
 - o proof of concept,
 - o validation in laboratory or by simulation,
 - o technical validation by experimentation
 - o and transformation into focused evidence of frontier idea.
- one stream of free bottom up call for new frontier or focused research small projects to tackle with the scientific problematics and development:
 - o this shall be opened every year for a small number of small research projects nurturing new ideas in parallel to the agenda driven thematic programs and projects described in 3.7. The evaluation of these bottom up projects all besides the traditional scientific excellence and relevance and management, shall be around the potentiality to cut through innovation path of existing tracks.
- one stream about urgent research activities linked to the development of the innovation cycle to overpass practical barriers to implementation:
 - o The main criteria of selection shall be the time and cost gained to overcome quickly these barriers that are stopping or braking the normal innovation cycle.

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This shall be evaluated ex post by a sub-group of the Advisory Board with experts from the funding agencies.

3.6 Education and training for professionals

Professionals are all staffs of industry, including operators or public bodies.

The transformation of the transport and its landscape needs to think about the education and training for professionals.

Two manners of knowledge transfer to professionals that could derive from the JRI are envisaged:

- transfer for fresh knowledge to existing professionals,
- Scientific knowledge for international harmonization

These activities shall consist of:

- two bi yearly training seminar series made of fresh knowledge coming from the JRI activities:
 - o one for industry or operators,
 - o one for public bodies and authorities.
- Participation to the elaboration of new educational curriculum such as bachelor, master, tutorial for new professionals.
- Participation to the elaboration of new educational and training curriculum for professionals who will gain a new benefit in their own career (evening university).
- Participation to the elaboration of new training path for professionals who need to adapt their skills.
- That could be within a new type of university (a European “Jiatong” one)

3.7 Dissemination and outcomes

A plan for the dissemination shall be prepared for JPA1 and adapted to its experience and the outcomes to JPA2.

It shall be based at most on the open innovation model, even a part has to be protected and closed.

Besides outputs, outcomes have to be evaluated and disseminated during the life of the JRI; this shall be done by a bi yearly monitoring outcome sub-report of the report presented to the Advisory Board and to the various interested forums.

The plan for dissemination shall consist of:

- General communication on the JRI by presentations,
- Transformation of raw evidence in exploitable knowledge useful for various stakeholders:
 - o scientific peer review articles, PhD books or volumes,
 - o patents and other IPR issues,
 - o specific scientific events or workshops,
 - o specific content for training and education,
 - o special session in conference,
 - o bi annual scientific conference,
 - o production of dissemination articles.
- Dissemination through bi yearly scientific conferences
- Dissemination and management of open access knowledge:
 - o creation and/or development of an open access knowledge management system,

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- creation and / development of a control access / closed knowledge management system to serve local innovation ecosystems.
- Outputs and outcomes for citizens and society:
 - production of ad' hoc articles or books or citizens' summary in the vein of "scientists speak to citizens".
- Participation to awareness campaigns made by user/citizen trade associations.
- Preparation of blocks for master and doctorate schools (or ad' hoc university) and training.

The outcome sub-report shall be prepared by a specific JRI task force, who shall scrutinize all the JRI outputs and look after synergetic or systemic effects creating real outcomes.

It shall include not only if any the operational indicators, but also the indicators linked to the acceleration of innovation path or the integration towards a mid XXI century governance and style of research organization.

It shall be elaborated step by step and improve towards the real evolution of the JRI and the interaction of stakeholders.

3.8 Stakeholders interactions

The JRI shall interact with stakeholders in the following manner:

- first the JRI has an Advisory Board composed of experts of international academists, Pan European industry center scientists, to advise and interact on the evolution of the JRI and its thematic excellence and relevance and the quality of its processes to accelerate the production of scientific evidence for innovation, and any anticipation, forecast and prospective issues.
- second the JRI shall interact through reports and presentations with the official forums dealing with transport research or ICT for transport at their request or the EC request.
- Third the JRI shall organize interactive relationship through virtual means or meetings separately every two years with:
 - the industrialists,
 - the operators,
 - the public bodies and / or Member States following the good experience of the forum NOEs (physical meeting prepared electronically, and virtual meetings).

That could conduct to joint scientific workshops or to specific policy workshops and/or to the presentation of the vision, prospective and forecast activities during the JRI.

- Fourth twice their duration a citizen - society event shall be organized around a document to receive comments, and also through official user forum if any (FIA type or others).

3.9 Governance and management outcomes

3.9.1 *Introduction*

There shall be four parts in this last issue:

- A general scheme of JRI
- JRI governance
- JRI daily management
- JRI governance and management outcomes

3.9.2 *General scheme of a JRI*

Based on the previous sub-chapters, this following diagram explains the general layout of the activities.

JRI General Scheme

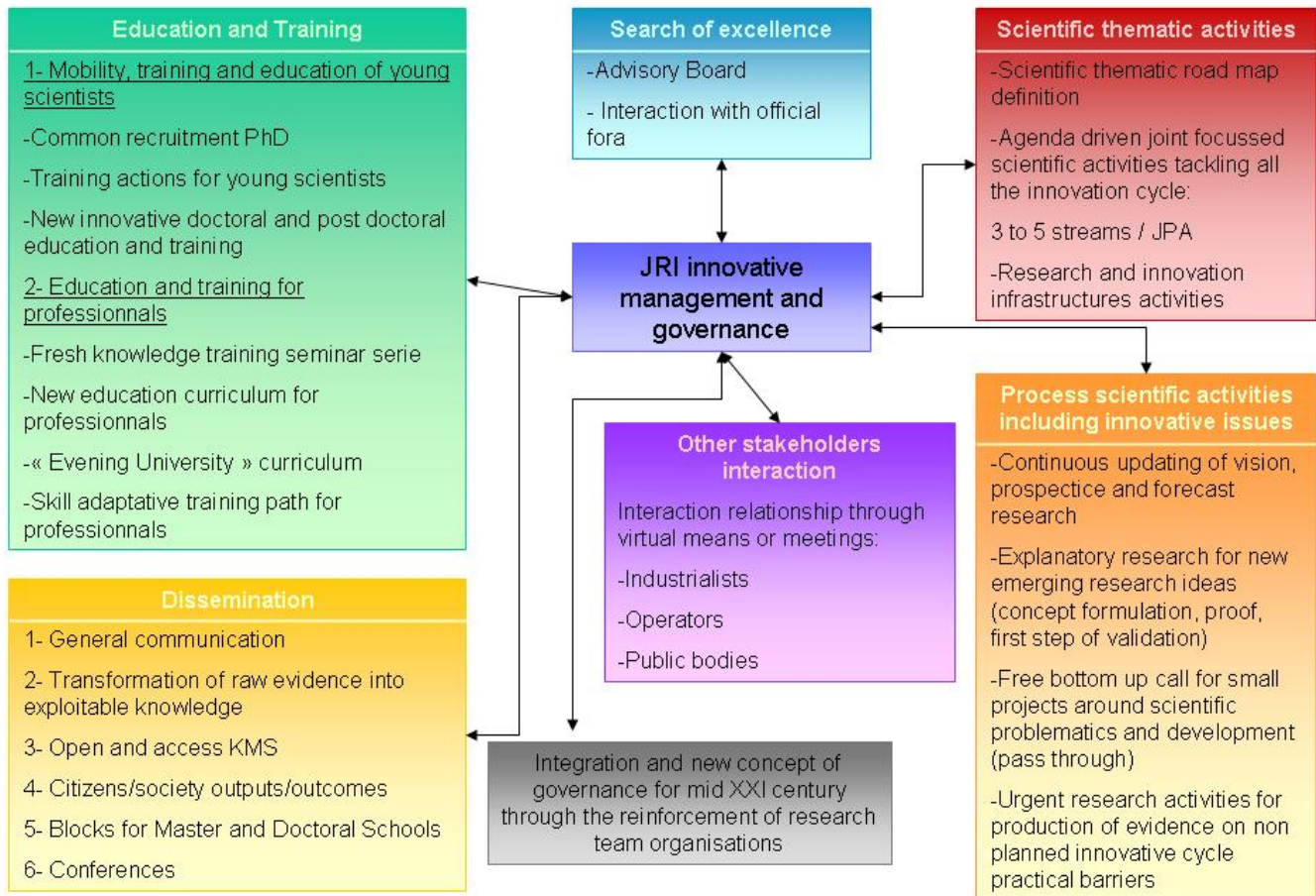


Figure 5. JRI General Scheme

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The following figure is showing the articulation between the two JPAs.

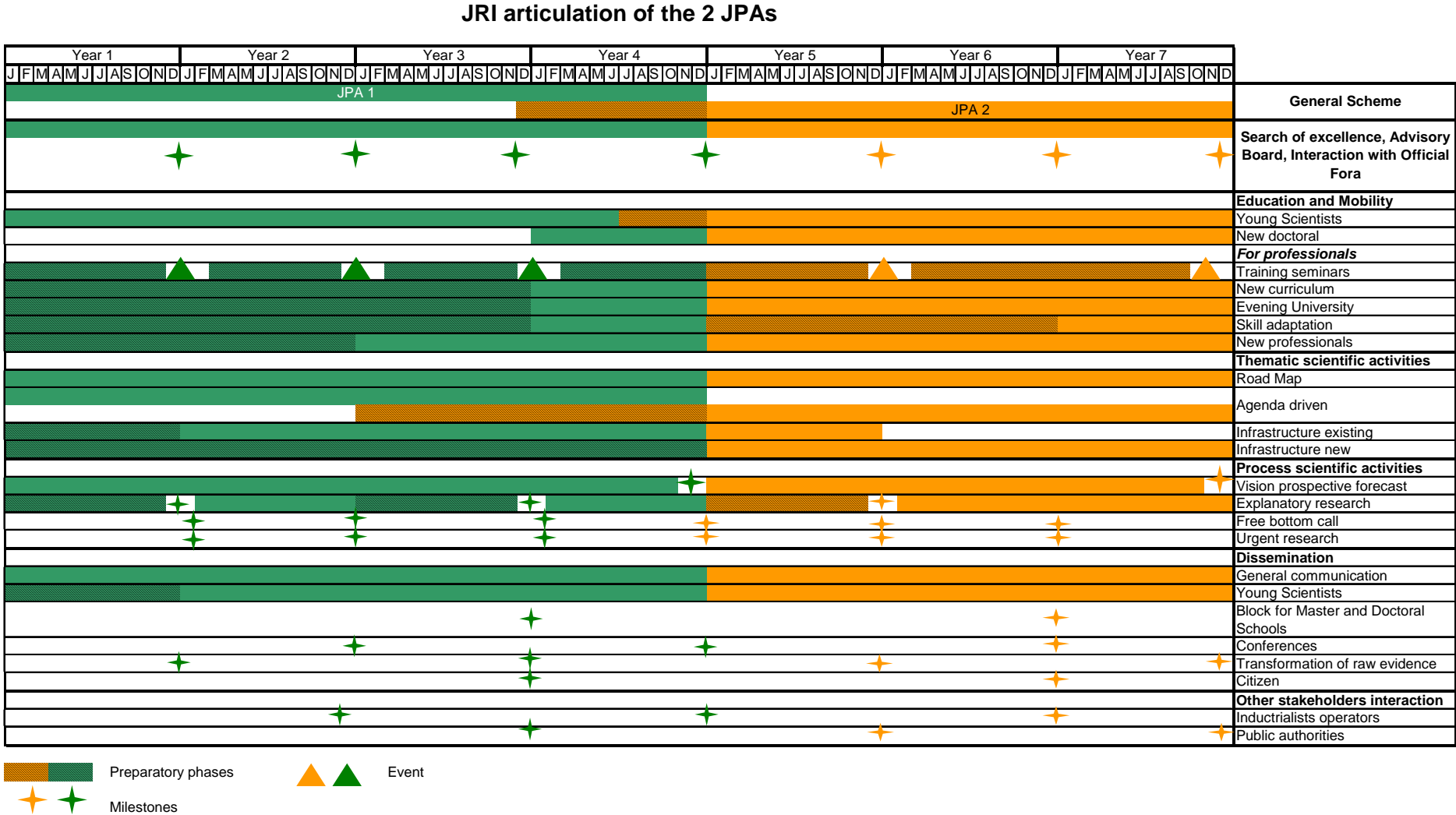


Figure 6. JRI articulation of the 2 JPAs

3.9.3 JRI governance

The previous sub-chapters lead to present the following schema for the JRI governance:

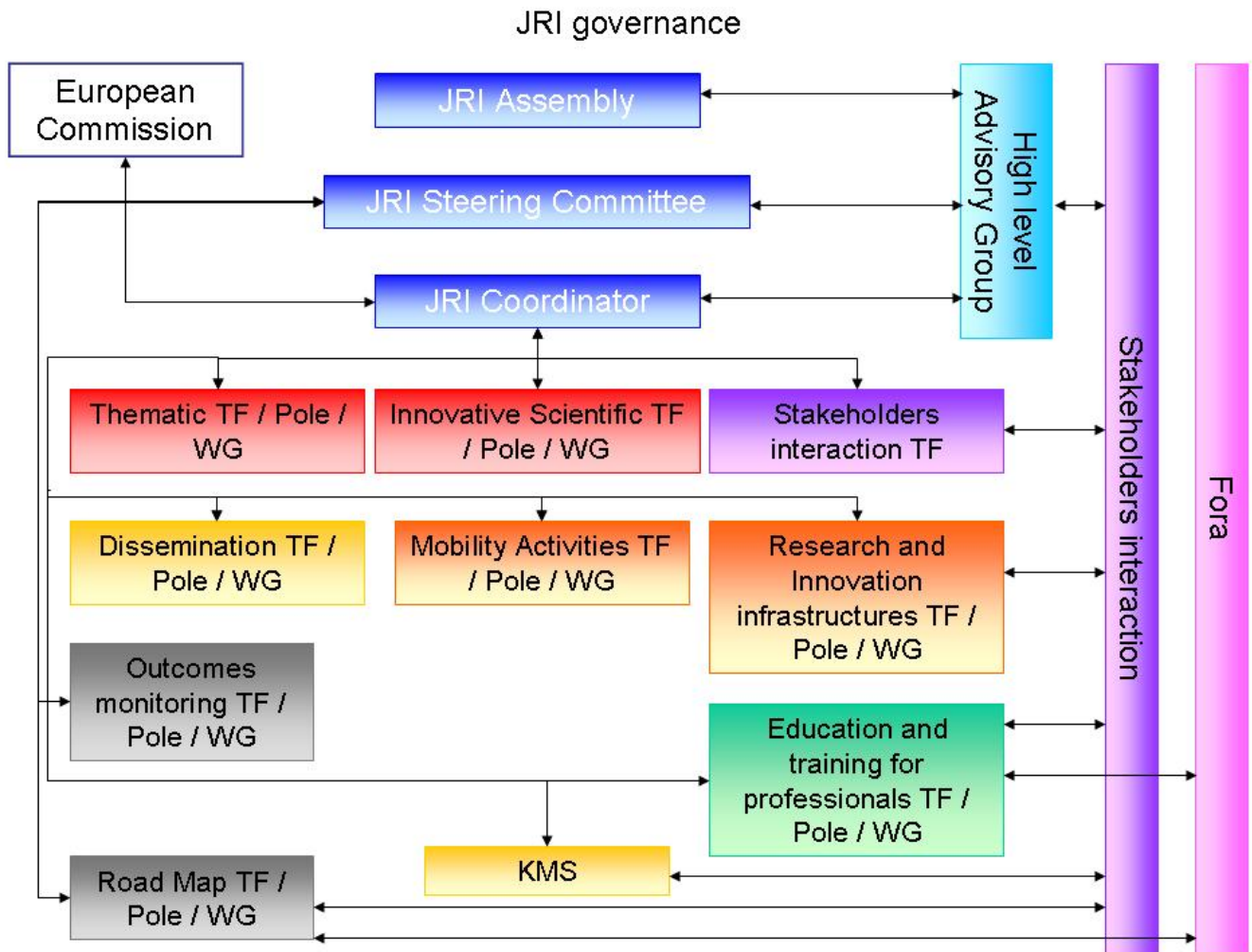


Figure 7. JRI governance

3.9.4 *The JRI daily management*

The following figure is summarizing the JRI daily management per JPA.

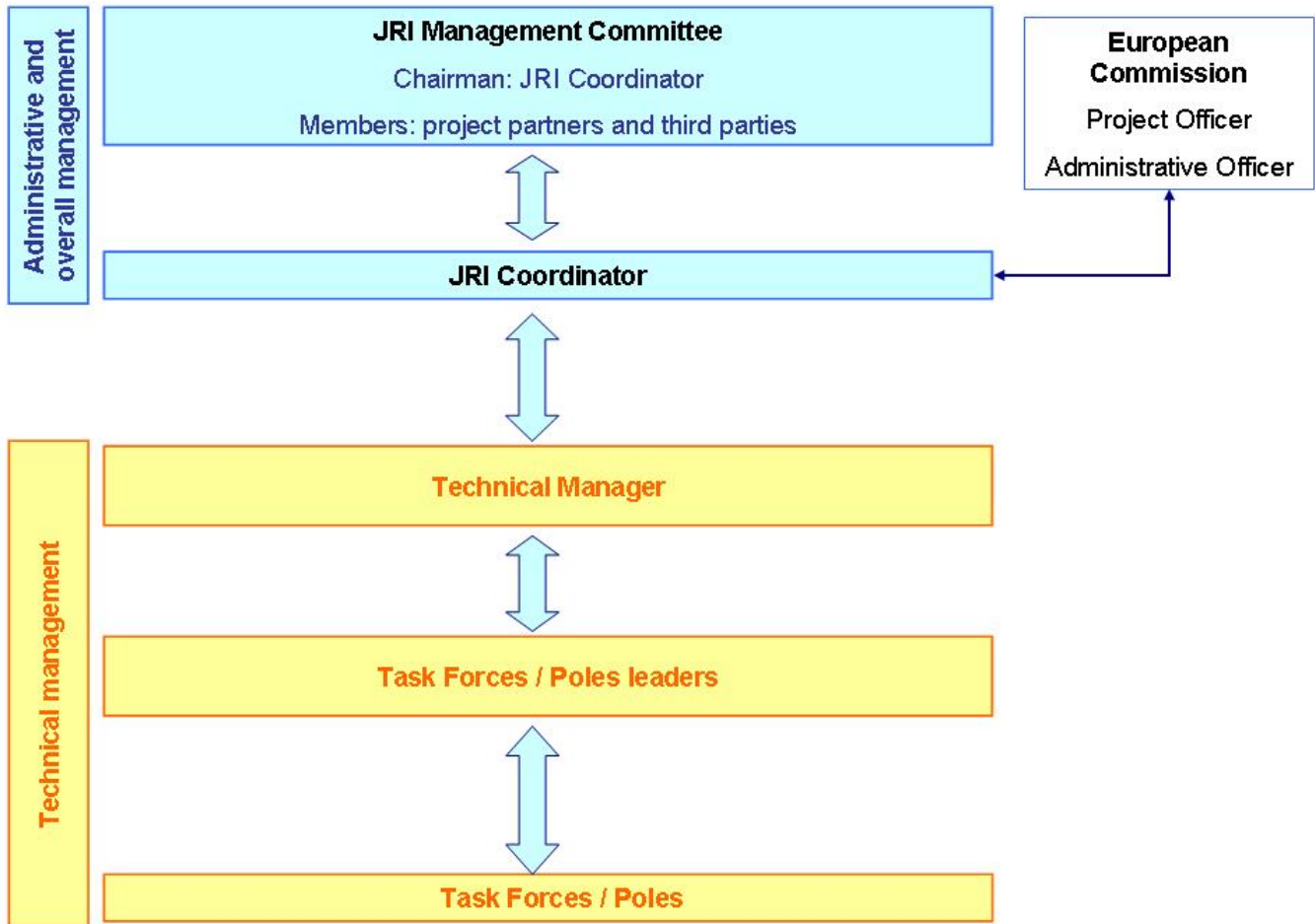


Figure 8. JRI daily management

3.9.5 *JRI governance and management outcomes*

The analysis of the results and outcomes of the two first BPs linked to the two JPAs shall conduct to the third Business Plan for after initiative (see 5.1).

From the management and governance part, could be drawn outcomes useful for mid XXI century scientific community and relevant for the JRI domain.

4. How to be feasible and operational

4.1 General issues

The experience of the current transport (or ICT for transport) related Virtual Centers of Excellence coming from Forum FP6 NoEs is one of the basis of the feasibility and operationally of the Joint Research Initiative, as well as the Lyon Declaration Signatories, and DETRA or EREA thoughts.

A good vision of what is a Joint Research Initiative and the domain it aims is critical, as well as the presence of a proactive and creative scientific community towards the other stakeholders from industry, society and public bodies.

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A good approach of the strategy because of leaders of their scientific communities, or the presence of road map task force and their involvement in the preparation of the next generation of research and innovation perspectives including through ETPs and other forums is another good news for the feasibility.

And the presence within these communities of thematic task forces, working groups or poles operational and contributing to strategic inputs is overcoming the operational difficulties, as well as the process oriented or the core business activities of these communities, including non open access deliverables on these issues including indicators, KMS, education and training, research and innovation infrastructure.

The best of is to proof some of the feasibility and operationally of the JRI concept with an illustration of a potential JRI draft.

4.2 Outcomes

The first deliverable has been discussed internally to DECOMOBIL/HUMANIST partners and member. It appears that the experience of HUMANIST NoE and VCE shows the feasibility and operationally of the concept. Discussion around potential JRI theme has been made.

It has been discussed with FP7 DETRA project partners mainly within its WP3 (reinforcing research institutions) but also within WP5 (research programmes) and also around the “ways and means” and “terms of reference” of the future European Transport Research Alliance.

DETRA project retains as main output on reinforcement of research institutions the need to have Joint Research Initiatives following the model developed within DECOMOBIL.

The scientific community for maritime or aeronautics research look carefully to these ideas and deliver first ideas for eventual JRIs interesting them.

So, besides the EU Presidency of Poland and Denmark who recommend to introduce for the transport related research and ICT for transport related research part of Horizon 2020 this concept of JRIs, the full transport related scientific community proposes not only to retain this type of research cooperative initiatives – the JRI – within Horizon 2020 but also to push forward through DETRA WP5 a first list of feasible ideas of JRIs including the ideas of JRI pushed forward by DECOMOBIL (see chapter 7).

- Human factors for Surface Transport (HUMANIST, EURNEX, ECMAR Association).
- User-centred design for eco-multimodal mobility (HUMANIST).
- EURAIL Next generation skills and competences (EURNEX).
- Surface Transport Infrastructure (EURNEX, FEHRL).
- Multimodal noise abatement by optimised structural dynamics (Sectors: maritime/ rail) (ECMAR Association, FEHRL, EURNEX...).
- Step change technologies for rail 2050 in a co-modal environment (EURNEX, NEARCTIS, HUMANIST, FEHRL...).
- New concepts for modal safety and co-modal safety (FEHRL, HUMANIST, ISN, EURNEX).
- Advanced Transport Network Sustainable and Intelligent Operation (NEARCTIS, FEHRL, HUMANIST, EURNEX...).
- Simulation and modelling of transport capacity/efficiency, environmental and system aspects (NEARCTIS, HYCON2, FEHRL, EURNEX...).
- Scientific knowledge for international harmonization regarding safety, operation and CO2 (FEHRL, HUMANIST, NEARCTIS, ISN, EURNEX...).
- Virtual testing and Simulation facilities for infrastructure (FEHRL, EURNEX, HUMANIST...).
- Virtual testing and simulations for vehicle safety (ISN, VPH, HUMANIST, FEHRL, EURNEX...).

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- Climate change adaptation testing structures network (FEHRL...).
- Green infrastructure design, construction and maintenance (FEHRL, EURNEX, HUMANIST...).
- Transformative research for transport infrastructure (adaptable and reliable, automated, resilient) (FEHRL, NEARCTIS, HUMANIST...).

This deliverable is detailing ideas where HUMANIST/DECOMOBIL could be critical in chapter 7.

Parallely, the stakeholders of DETRA partners meeting in DETRA workshop of WP3, WP4 and WP5 found this idea very fruitful and useful for the future Horizon 2020, as well as the iMobility research and innovation WG pinpoints the importance to reinforce the supply side of the European Research Area whom JRIs could be a critical part.

And finally the ways and means of an eventual European Transport Research Alliance and its draft ToRs pushed for forward in any case on the agenda to big bricks of JRIs.

5. Framework for Business Plan Principles and Indicators

5.1 Business Plan

To ensure that a convergence and good management to carry out the project and to continue the project after its end, a three steps business plan for the JRI shall be produced:

A first one (BP1) based on and comprising JPA1 and on the Consortium Agreement, and the Business Plan for Integration and Sustainability if any of relevant VCE from former NoEs.

A second one (BP2) for JPA2 prepared during JPA1 year 4 including the governance and management tested results of JPA1 first years.

A third one for the after project (BP3) on the model of a new BPIS type for the second mid XXI century research community of the JRI field. This third business plan shall be covering all issues of what should be the relevant and scientific community for the mid XXI century in the domain of JRI.

5.2 Indicators for outcomes and inputs

5.2.1 *Background*

According to the quality concept, a methodology is proposed to assess the quality of a process, based on the definition of main results to achieve and on the identification of indicators to measure, step by step, the progresses towards these results.

To help consortia of NoEs monitoring the progresses of their project, the European Commission (EC) proposed some general results to be obtained to ensure that the integration objective of a NoE is achieved. This EC base work has to be taken into account as a useful model to explore for the working-out of JRI performance indicators.

5.2.2 *Conceptualization PDCA Model: Deming's wheel*

Often called "wheel of Deming" or wheel of quality, this model includes/understands 4 distinct stages which follow one another indefinitely: To Plan, Do, Check, Act. Regarding the wheel of quality, an indicator based quality assurance process is specified by following four steps:

- 1) Plan Definition of performance indicators by means of project workplan and project specific definition of quality.
- 2) Do (Performance rating) Determination of a performance rating by means of performance indicators and project status:
 1. Performance is rated for each indicator separately.
 2. Impact of the rating is assessed (plans for assessing the impact of NoE activities and results can be included in the current assessment plan without introducing major changes to the structure of the

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assessment framework – some suggestions for doing this are included in Annex A of this Review Report).

- 3) Check (Definition of corrective activities) Assessment is used to define corrective actions.
- 4) Act (processing corrective activities) Modification of specific project aspects (like objectives, tools, methodology, deliverables).

These four actions must be considered and be understood as a great tool to assure the monitoring of the project and allow to the consortium to achieve these objectives by excellence.

5.2.3 Methodologies to assess the quality of a process

Based on the quality concept, the methodology to assess the quality of a process is as following:

- Setting up of sufficiently ambitious results to be obtained for the achievement of the objectives
- Definition of intermediate steps covering:
 - Specific operations necessary for the setting up of common tools (informatics, equipment, installations, facilities,...)
 - Administrative and legal operations necessary to allow for a common use of these tools by all participants
- • Identification of indicators of the progress achieved, mainly under the form of measurement of the degree of achievement of the intermediate steps.

5.2.4 JRI approach

This approach is intended to describe the JRI specificities and to explain why and how to make sure that the indicators are tailored to JRI needs, the JRI vision.

Mobility and training are key issues for the development of the JRI. The objective is to foster and facilitate the mobility of researchers and the exchange of knowledge and experience between partners. In the fields where important gaps in scientific knowledge and new relevant research issues have been identified, the JRI will foster and support international PhD proposals and joint PhD Direction.

An essential feature of the activities will aim at spreading excellence is a joint program of training. The target population will be the early-stage researchers of the network. Indeed, training and education of a young researchers' pool in this area through the JRI activities will constitute an additional important element to maintain the integration in a long term perspective.

5.2.5 Progress assessment

The JRI dashboard provides us the framework, but this framework is not sufficient for an actual monitoring of the JRI. The framework will be useful and usable if the following questions are answered:

- What progresses to assess?
- When to assess the progresses?
- How to assess the progresses?
- What progresses to assess?

A JRI is a very peculiar type of project. Indeed, a JRI is and remains a new innovative project and partners are implementing a "learning by doing" process what implies to have recourse to "trials and errors". One knows the starting point and the theoretical trajectory without really being able to know the exact outcome of the process, because it is governed by an incertitude principle. In this view the JRI are the illustration of the last developments of sciences of innovation and creativity with a background of complex systems dynamics.

The objective of JRI is to reach a certain level of integration of partners. So the planned activities of the project are made to achieve this integration. So monitoring the planned activities should consequently permit to assess

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the progresses towards integration. Nonetheless, albeit it could seem useless to monitor both activities of the Project and progresses towards integration, because the projects activities are leading to the integration, both have to be monitored. Indeed, both matters don't always go hand in hand. On one hand, the integration could be reached but the planned activities are not performed, on the other hand, the performance of planned activities could lead to a non achievement of the main objectives, the integration. The partners involved could follow perfectly the planned activities but be unable to reach the integration because the first objective could be not relevant in fact to achieve integration and some adaptation could be needed. So, two types of assessment of the progresses have to be made: the assessment of the activities of the Project itself and the assessment of the Progresses towards integration.

The indicators of the progress achieved may be defined as quantitative goals easily checked at the end of each year as well as qualitative goals which could necessitate a deeper analysis. An example of quantitative indicator could be the number of personnel exchanges amongst participants. But for instance a very high number of exchanges of personnel observed during one specific year is not sufficient to demonstrate a real commitment towards integration. In this case, it is necessary to observe the history of this number of exchanges on several years, to analyse the added value of these exchanges for the JRI community and to propose actions to last these activities once the support of the European Commission will be over. There is the same problematic with the setting up of common tools for research by the partners. Although this is an essential condition for durable integration, this does not per se demonstrate the will of partners and the reality of the durable integration sought. The setting up of these common tools, the increasing of their use and their adoption instead of their usual working ways by all participants will constitute an illustration of progress towards integration.

For this reason, we need evolutionary indicators that are accountable of the real level of performance and integration achieved by the JRI. Therefore the activities dedicated for the young researchers have not only an impact on the quality of the PhD but are also an added value for the specific type of scientific production needed by the scientific competitiveness of Europe in the coming years.

To make sure the progresses towards integration is an excellent process; some indicators of relevance for addressing stakeholders' scientific needs and societal issues have to be added. Indeed, the relevance is critical to ensure the integration of research is also useful for society, and that the integration is not leading to an isolation of partners. The relevance of research has also to be monitored for itself.

These different remarks illustrate that two different kinds of progresses have to be assessed.

As for any project, it is needed to demonstrate that what has been planned is actually achieved. The first series of indicators will then aim at assessing the activities of the JRI.

The second type is made to make sure that the main objective of durable integration and performance within a JRI is taken into account correctly. So the second series of indicators are design to assess the progresses towards the new type of mid XXI century research Community Governance as short integration.

The demonstration of the progresses either of the project or of the achievement of the integration will be based on measurable criteria to help to the decision.

When to assess the progresses?

The assessment of both series of indicators will be reported annually.

How to assess the progresses?

Both types of progresses have to be assessed. The indicators of the progress achieved towards integration or outcomes are not easy to check.

The rules to qualify the degree of achievement are the following ones. Each objective will be qualified according to achievement of these activities identified to achieve it.

It will be used, for the JRI, a value to correspond to a degree of achievement as shown below:

- 3 = completely achieved,

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- 2 = partially achieved,
- 1 = scarcely achieved,
- 0 = not achieved at all

A value assessing that the result or the step is not achieved does not mean that the progresses towards integration could be challenged. Indeed, the results planned could be changed for other results according to the proper evolution of the JRI. The JRI may find more efficient for the integration to set aside some results and to focus on other results that are more relevant and more efficient for integration. For instance it may appear that the visit of senior researcher is less efficient than the creation of a new generation of researchers because the senior researcher already know each other or have other means to share.

The assessment of the achievement of the steps will be made by an ad' hoc JRI task force and members of the JRI Advisory Board. Every year, an item of the Agenda of the Scientific Advisory Board will be dedicated to the assessment of indicators, i.e. to the evaluation of the degree of achievement of each step of the evolutionary indicators.

For the indicators of the activities of the Project, the assessment will depend on the threshold foreseen that fix the target to reach at the end of the project. The assessment is simply based on the steps towards the expected results. The assessment will be done by the Management Team.

Based on the outcomes and decisions of both Advisory Board and Management Team, the JRI Assembly will decide what actions have to be implemented to take into account the results of the assessments of both evolutionary indicators and indicators of the Project Activities. The decisions of the Assembly will be taken through the elaboration of the Joint Program of Activities, which is the mean to implement these decisions. These Assembly decisions will be discussed with the European Commission and the Reviewers of the Project during the Annual Review meeting as the Joint Program of Activities are discussed during these meetings.

At the end of the project the assessment of all sets of performance indicators will be compared to have a global evaluation of the Project results.

The global evaluation of the project will be included in the table that take into account the two sets of indicators, including the indicators of relevance that will be used at the end of the project and permit a comparison of the results of the application of each set of indicators. This analysis is very useful for the future of the JRI, and to assess the results at the end of the project.

5.2.6 JRI Performance indicators¹

Two sets of indicators have to define:

- Indicators for monitoring the activities of the Project.
- Indicators of the progresses towards integration and other outcomes.

Indicators for monitoring the activities of the Project

The activities of the project have to be monitored. These activities are possible because they are financed and because a budget is existing. Monitoring the activities of the project is then monitoring the budget assigned to the project and the results produced. The budget will be monitored through indicators of means and the activities through a table of indicators of activities.

Indicators of means

They characterize the resources available for the network. They are useful for the all users in the financial follow-up of the project: for the internal use made by the coordinator, and for th external use made by the Commission.

- Manpower assigned to the JRI
- Total Budget

¹ These indicators were cited in the frame of HUMANIST NoE Performance indicators Deliverable

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- Contribution in kind
- Actual costs compared to budgeted costs

These indicators, which may appear simplistic, are based on elements of the project itself. Indeed, the 4 criteria used here, are strongly dependent on the objectives of the projects for which means must be implemented to achieve them.

As a function of time and levels of completion of project activities, the indicators means are updated regularly on evidence and on facts. With these criteria it is possible to view and show both on facts and quantities: the progress reports of activities, and the involvement of partners in the project.

Evolutionary Indicators of general outcomes and integration / performance

For evolutionary indicators, we are proposing two sets of indicators:

The first set of indicators allows us to monitor the progress of JRI towards integration. It is built on the definition of results to be obtained and of the intermediate steps to be assessed to monitor the progresses towards these results.

The second set of indicators will be created during the life of the JRI taking into account the real outcomes. So, new indicators will appear in the lifetime of the network. They are not foreseen at the beginning of the project, but the achievement of these new results shows the quality of the JRI partnership. These indicators are arising through the evolutionary process of JRI. Developing new indicators instead of planned ones, is required by the specific nature of a JRI. What could be seen as a deviation is in reality a need of the “learning by doing” process where capacities of adaptation could be more important than the exact realisation of planned objectives.

At the time of this deliverable we are proposing a first series of ideas that could be transformed into evolutionary indicators:

- creation of a new specific academic educational curriculum (Master and PhD),
- creation of a new pattern and brand of young researchers that will be the next generation of scientists for academia and industry,
- setting up of innovative means of interactions with stakeholders,
- common knowledge shared with stakeholders of potentials and limits of partners Infrastructures and methodologies,
- common knowledge of partner’s ways to address ethical issues for a harmonized approach of these issues,
- common production of ideas for internationally relevant excellent project,
- international recognition of the knowledge generated and of the processes implemented to produce this knowledge within the network,
- indicators on team building and community building at scientist level and at top level manager level,
- indicators of the quality of the effectiveness and complete convergence of new members,
- architecture of electronic tools supporting the JRI,
- setting up of formal process to identify the scientific gaps, to prioritize the gaps, to specify the research prospects needed to fill these gaps in and to define a common programme of actions to tackle the research issues.

Indicators of relevance and dissemination

To ensure that the integration is useful and that the outcomes of the JRI are relevant regarding the Stakeholders needs and societal issues, it is highly recommended to have indicators of dissemination and scientific relevance.

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They specify the whole products of knowledge of the JRI research community since the bibliometry indicators such as the articles and scientific papers, until the activities of diffusion towards general public of the results of research; they take into account the activity of transfer towards people outside the network. They also specify the contribution of research to the socio-economic activities. They are at last indicators of the interaction between the research carried out within the network and people outside the network.

The proposed indicators below should be used at the end of the Project and for all the JRI, and not for each partner individually, because they aim at assessing that the integration is useful and relevant:

- scientific articles in international journals,
- defense of PhD thesis related to JRI thematic,
- scientific conferences (papers and conferences invited),
- professional technical texts,
- products of diffusion all supports
- marks maintained active,
- creation of companies or spin offs,
- time spent to the regulation, standardization, certification, technical production, production in
- socio-economic matter,
- resources coming from the technical production and in socio-economic matter,
- time spent to the activity of opinion, appraises, consultancy, council, R & D,
- resources coming from the activity of opinion, appraises, consultancy, council, R & D, of actions in network or partnership, other contractual activities,
- time spent to the activities of teaching,
- time spent to the activities of formation,
- participations at reading panels, presidencies of international committees,
- capitalization of knowledge and know-how.

5.3 Other outcomes

The other JRI outcomes shall be based on a strict compliance with the open innovation model and IPR to discriminate between access or free access and closed access.

Closed access issues are of the full responsibility of the participants and not supported by the JRI, even the JRI activities are conducting each participant to revisit its open access (not free) or free access policies based on the best practices principles and the most convergent and standardized ones within the JRI.

They shall consist of:

- vision and research and innovation road map inputs for stakeholders forums (such as ETPs or any other European or national forum)
- scientific smart specialization at European and global levels, and the acknowledgement of scientific excellence and relevance,
- evidence basis for standardization, rule and policy making or monitoring
- knowledge management system (open access)
- ad'hoc observatory based on the SETIS type model in an eventual connection of not with the JRC
- translated evidence to the society and the citizens: one suggestion is to make during JPA2 a series of short articles for newspapers or a small book in accessible language and format to citizens.

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6. Funding scheme proposal and other funding issues

6.1 General issues

The partners of a JRI are involved in a European cooperative project aimed at reinforcing the ERA supply side. Therefore the funding is expected to be coming from EU side and from the partners side, and for the EU side from the Horizon 2020 rules of participation and funding schemes.

Following is described the funding of various blocks of a JRI with the currently planned Horizon 2020 funding schemes.

6.2 Education and training

6.2.1 *Mobility training and education of young scientists*

The Marie Skłodowska-Curie funding scheme suggested to be retained are around the ITN scheme. The volume of grant could be for these 7 years 7 to 10 M€.

6.2.2 *Education and training for professionals*

The Marie Skłodowska-Curie funding scheme suggested to be retained are that of a training CSA. The volume of the grant could be because of external receipts of 2 to 3M€ for the seven years.

6.3 Scientific thematic activities

6.3.1 *Research and innovation infrastructures*

The funding of these activities shall be based on both

- Marie Skłodowska-Curie funding grant to send people to other research infrastructures
- 13 CSA for the optimization of the existing research facilities for fostering the potential for innovation of the existing and new research infrastructure for supporting the emergence of new Pan European Research and Innovation infrastructures taking into account in this case the cost of realization.

The suggested grant for the seven years should be from 3 to 5M€.

6.3.2 *Scientific road map definition and updating and agenda driven joint focused scientific activities tackling all innovation cycle*

The suggested grant for the seven years shall be following the traditional cooperative project funding for Horizon 2020.

The importance of the suggested grant for seven years depends on the members of the main scientific streams of the 2 JPAs.

It should be in the scope of 10 to 20M€.

6.4 Process scientific activities including innovation issues

6.4.1 *Continuous updating of vision, prospective and forecast research*

It is cooperative project in the manner the JRC is doing with its associated network.

For the seven years it should be in the scope of 1M€.

6.4.2 *Exploratory research for new emerging ideas and urgent research activities for production of evidence*

It shall be conducted after request of the official force and/or Advisory Board request.

The grant shall follow the model of cooperative projects decided during the project. It shall be in the scope of 2 to 4M€ for the seven years.

6.4.3 *Free bottom up call for small projects*

It shall be conducted following the updates of roadmapping and prospective and forecast research after advice of the Advisory Board on the call to be launched. It shall be in the scope of 2 to 4M€ for the seven years.

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6.5 Dissemination and stakeholders interaction

The suggested type of grant is that of a CSA. That should be in the scope for the seven years of 3 to 9M€.

6.6 Management and Governance

Including the organization of interaction with official for a (ETPs, iMobility forum) and meeting of the Advisory Board (mainly travel expenses of experts from the JRI or outside the JRI partners), the rest of the management and governance is more traditionally planned, nevertheless it includes a part of time and travel expenses expert for framing the second JPA.

The scope of the grant could be between 3 to 6M€.

6.7 Conclusion

So in total a JRI could request a 40 to 70M€ grant following this model.

In any case the results of the JRI shall be based on the set of indicators discussed in the chapter 5.

	Grant request – in M€	Others
6.2 Education and training		
6.2.1 Mobility training and education young scientists	7 to 10	
6.2.2 Education and training for professionals	2 to 3	External receipts
Subtotal for 6.2	9 to 13	
6.3 Scientific thematic activities		
6.3.1 Research and innovation infrastructures	3 to 5	
6.3.2 Scientific Road map and agenda driven agenda	10 to 20	Depends of the number of streams of 4 years (5 to 10)
Subtotal for 6.3	13 to 25	
6.4 Programme scientific activities		
6.4.1 Updating vision, prospective	1 to 1	Seminars
6.4.2 Exploratory and urgent research	2 to 4	On official fora or Advisory Board request
6.4.3 Free bottom up small calls	2 to 4	On Advisory Board advice
Subtotal for 6.4	5 to 9	
6.5 Dissemination and stakeholders interaction	3 to 6	
6.6 Management and Governance including second JPA framing	5 to 7	
TOTAL	35 to 60	

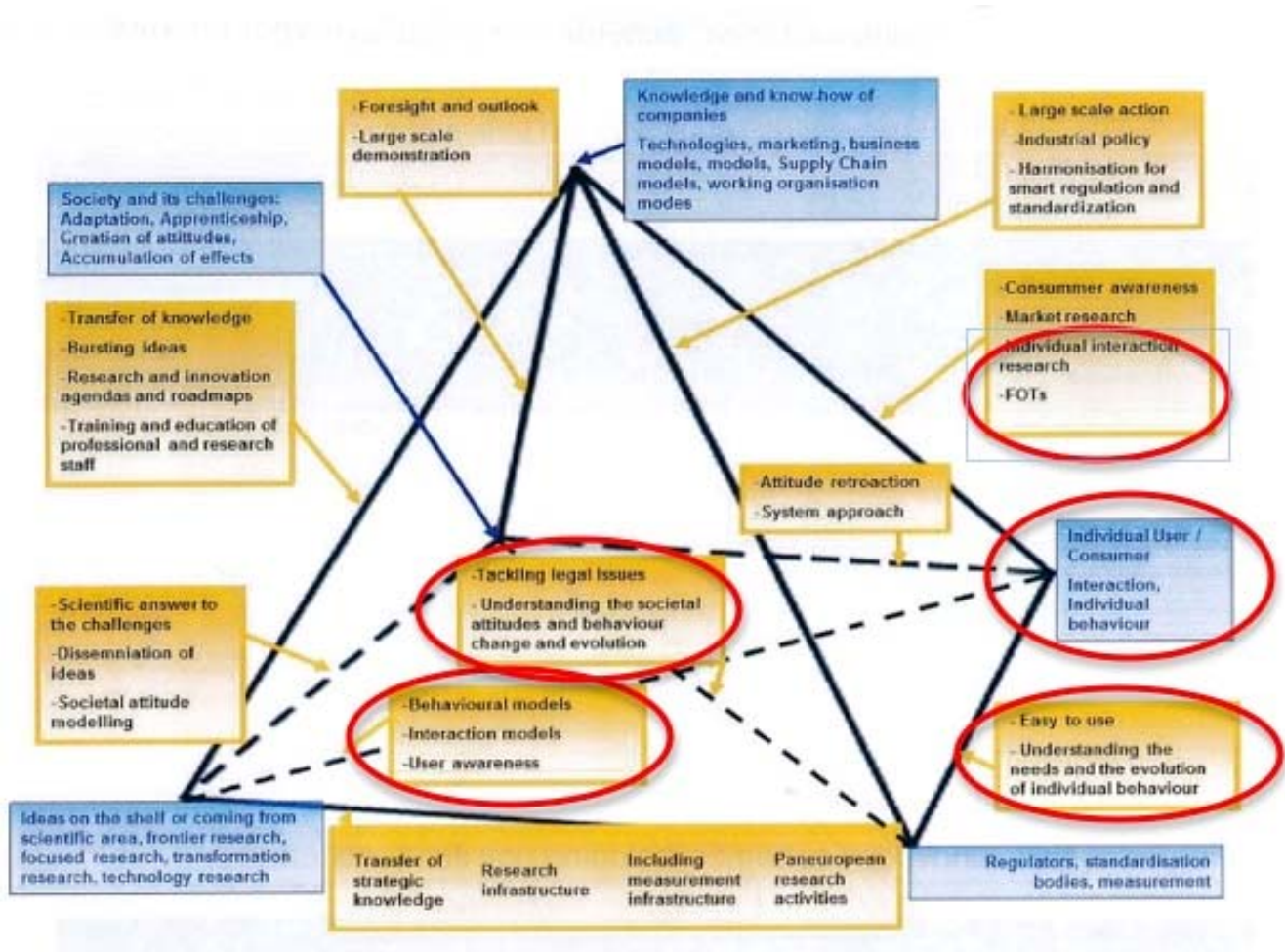
7. Ideas of JRIs coming from HUMANIST/DECOMOBIL

7.1 Human Centred Design for eco-multimodal mobility

JRI can cover several research topics directly linked to Human centred design: individual interaction research, FOT, behavioural models, interaction models, user awareness, individual user/consumer, interaction, individual

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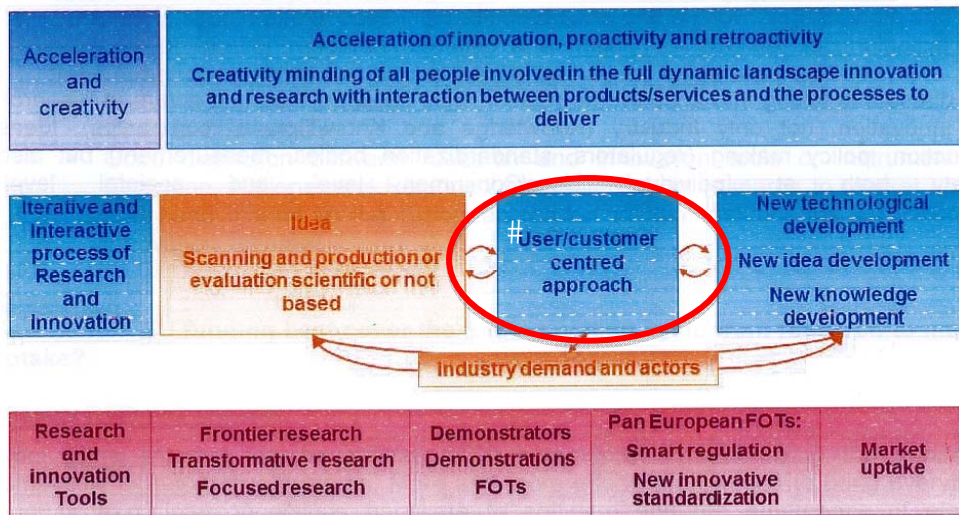
behavior, easy to use, understanding the needs and the evolution of individual behavior, tackling legal issues, understanding the societal attitudes and behavior change and evolution.



In the new innovation schemes including non linear schemes, the research conducted in DECOMOBIL and Humanist is clearly identified in “User/customer centred approach making the connection between ideas and new technological development”.

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New innovation schemes including non linear schemes



Ref. J. Schumpeter model
OECD – EC/EUROSTAT Oslo manual 3rd edition
Innovation Manual Wiley 2009

Some main research priorities in the area covered by DECOMOBIL/Humanist:

Fully electric vehicles in a multimodal transport system

The development of alternative fuel vehicles is posing new challenges to road transport. The human factors aspects have to be considered if an efficient uptake of alternative fuel vehicles is aimed to accelerate the decarbonisation of transport. The intrinsic characteristics of fully electric vehicles might impose changes to the driving task. These changes are not only at an operational level but also at a strategic one, as a way to overcome the limited energy resources. The decisive factors influencing the acceptance of such vehicles are to be tackled, together with the mechanisms to promote its adoption. The main safety concerns must be analysed and the collection of critical incidents while driving and handling these vehicles serve as a basis for studying causation and mitigating problems. Fully electric vehicles will be one element in a connected multimodal transport system. New technology will be necessary for the integration of different mobility systems together with infrastructure.

Social media for ecomobility

Social media is a chaotic and still developing phenomenon. Channels such as Twitter and Facebook are becoming ubiquitous and are highly popular with many younger people who could also be considered as good “targets” to influence towards multi-modal mobility as well as ecodriving. Social media can provide not only information but could help to enhance motivation, through shared social values, to embrace ecomobility such as use of public transport and participation in car-sharing or in eco-driving practices.

Sustainable driving/riding training aiming at safe and cost efficient behavior enabled

Sustainable driving/riding training research focuses both on the combined use of ICT and driving simulators for training of all road driver/riding categories and the training of all types of drivers/riders on optimal use of ICT tools that support drivers/riders or are used by them during driving/riding. New simulation tools are expected to be developed for motorcycle riding and passenger car (both for novices and emergency drivers/riders), as well as truck driving.

Design, integration and safety of mobile services for ecomobility

Easy access to information through nomadic devices has high potential benefits for a clean and efficient multi-modal mobility: incentive to use public transport and self-serve bicycles, avoidance of traffic congestion, encouraging and supporting ridesharing, low cost service of eco-driving...

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Human centred design research in this area explores how to turn mobile devices and mobile applications toward a more sustainable transport context by inducing behavioural positive changes of citizens toward ecomobility without any negative impact on safety.

Cooperative service for a sustainable and resilient mobility

Cooperative Systems have the capacity (at short, medium or long range) to communicate some data to obtain specific road traffic service. The sensing capabilities of almost any type of data or needed information are evolving very quickly, at the same speed as the Internet of Things, where any device may be permanently and ubiquitously connected to Internet, requesting or providing information. This implies the possibility to collect a huge amount of information related to different aspects, such as people location, weather conditions, pollution, status of traffic, status of public transport, energy consumption, etc. Properly processed, this huge amount of information may provide relevant services to the Smart and Connected City, in particular, services related to Mobility.

These sensing capabilities, together with the communications and processing ones, bring up the concept of Cooperative Service. This is a horizontal service, covering different aspects, such as mobility in the city, low energy consumption and pollution reduction in particular areas, parking reservation, infotainment, etc., or a combination of all the previous. A cooperative service may be provided to users according to their needs and profiles, including personal and/or professional data. It is clear that the amount of data has to be processed and filtered in order to provide the user with exactly what she/he needs, at the right moment, at the right place, and with the most appropriate Human Service Interface.

ICT for Cooperative Systems for Powered Two Wheelers enhancement

ICT research in Cooperative Systems can be conducted for enhancing motorcycle safety via vehicle-to-vehicle and vehicle-to-infrastructure communication for critical scenarios such as intersections, rural roads, etc. Through the design and development of motorcycle-based Advanced Rider Assistance Systems (ARAS) and On-Bike Information Systems (OBIS) functionalities and their combination with deployed accurate positioning systems, smart infrastructures and automotive active safety systems, it is expected to minimize the increasing number of motorcycle accidents, with special emphasis to novice and elderly riders. Special focus should be given to the further research and integration of the eCall system in motorcycles, focusing on the complexity of motorcycle accidents, where the vehicle and the rider are separated. Research should include the design and/or adaptation of rider-friendly Human-Machine Interaction and decision support systems that will communicate prioritized information from all ARAS/OBIS and other services to the rider, through advanced safety warning strategies, considering the complex and weighed riders' workload.

Design, integration and safety of highly autonomous driving

Autonomous vehicles have the potential to make a significant difference to the safety and efficiency of transportation. The research focus thus far has been on making autonomous vehicles systems that operate safely and effectively with less consideration given as to how humans interact with such systems. The use of driving simulation is becoming increasingly prevalent in the development of advanced driver assistance systems; simulators are becoming more realistic in the way they present the simulated environment to the user, they can integrate complex simulated inputs such as those from radar and camera, it is cheaper and simpler to make small changes to software code and re-test in the simulator than to make changes to real vehicles and repeatedly test at track facilities and complex traffic scenarios can be created that might be impractical and/or unsafe to create in the real world. Research needs to explore the human factors issues in highly automated driving both for the driver of the automated vehicle (particularly in hand-over) and for the drivers of non-automated vehicles that will share the same road space.

Safe Road Transportation of Dangerous Goods addressing all types of infrastructures

Cooperative, dynamic and seamless services for Dangerous Goods transportation by road, making innovative use of the technologies, solutions and concepts that have been so far developed. These services and applications should aim to the optimal routing and re-routing of Dangerous Goods addressing maximum safety, security, environmental friendliness and cost-efficiency, as well as hybrid optimal guidance by weighted combinations of

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the above criteria. Relevant services should make optimal use of all types of existing and emerging communications and sensors, from autonomous to V2I, I2V and V2V. All components featuring the Dangerous Goods transportation, namely the transferred cargo, the vehicle and its critical components, the driver and all actors of the logistics chain (the infrastructure operators, the clients, the transportation companies, etc.) as well as external environmental factors (weather conditions, traffic conditions, etc.) should be addressed.

Holistic safety principle of children safety enhancement in road transport

Advanced vehicle safety systems, infrastructure based ITS and cooperative systems based on communication from vehicle-to-x or infrastructure-to-vehicle/user have to be implemented to enhance safety among children as passengers, pedestrians, bicyclists and PT users. Integrated and co-operative systems need to be developed to cover the children and enhance their safety throughout their whole route with multimodal transport modes. Additionally, the safety and comfort of children as passengers in private vehicles, as well as the minimization of their parents distraction while driving, need to be taken under consideration, using innovative technologies within the vehicle.

7.2 Human factors for surface transport (with EURNEX & ECMAR)

Some Human Factors issues are transversal to the different surface transport modes (road, railway and maritime), so there is a real added value of research cooperation in order to join effort and to share experience. A JRI devoted on Human Factors for surface transport will permit to put this cross-modal research cooperation into a concrete form around the following research topics:

- Human modeling including perceptive, cognitive and biomechanics dimensions for the virtual design of HMI, functions, systems or services.
- Actions and strategies to support system users to reach and maintain a correct mental representation of the system, to ease users' interactions with the system and to limit unsafe system use
- Automation: user acceptance, user control, hand-over and hand-back of automated systems, their impacts on non-equipped users
- Mitigation solutions of effects on safety of user characteristics such as level of experience, age, health impairment, inattentive and emotional states.

7.3 Other eventual ideas of JRIs where HUMANIST could be involved

7.3.1 *New concepts for modal safety and co modal safety (FEHRL leader)*

- Research and rules harmonization on intermodal transport of dangerous goods;
- Safety & security measures for infrastructure and multimodal Hub stations;
- "End to end" security certifications and joint security assessment schemes, covering all modes of transport towards building an "intermodal security chain";
- Harmonisation of rules for intermodal transport of dangerous goods, ensuring interoperability between all the modes; enhanced inspection and impact mitigation for transportation of such goods by rail.

7.3.2 *Advanced Transport Network Sustainable and Intelligent Operation (NEARCTIS, FEHRL, HUMANIST, EURNEX).*

- Innovative technologies for a sustainable & attractive European freight transport
- Development of smart mobility partnerships and demonstration projects for sustainable urban transport solution;
- Influencing behaviour, e.g. encouraging the use of more sustainable modes of transport, eco-driver training and using policy and incentives;
- Greening of transport, vehicle electrification, ICT for sustainable infomobility and cooperative systems implementation remain the major technologies in focus for further research into globalisation;

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- Promotion of European approaches globally, aiming at opening up transport markets to free and undistorted competition and environmentally sustainable solutions;
- Real-time transport network optimisation under adverse weather conditions due to climate change including the impact of wild fire and other threats;
- Development of criteria to determine the optimum site location for international companies in terms of optimisation of transport network and market proximity, for maximisation of manufacturing efficiency;
- Risk-based design principles of new vessels, following “intelligent concepts and designs” ;
- Advanced utility, sensory and communication systems for intelligent traffic and incident management;
- Development of traffic management and capacity models in order to allow more intelligent understanding of the effects of restraints and incentives on land use and trip making;
- Intelligent deployment of road space in relation to demand (tidal systems, lane allocation, and light weight temporary structures in areas of dense development);
- Traffic management: Deployment of smart mobility systems, such as the European rail traffic management systems (ERTMS), as well as research on new, intelligent management concepts and algorithms for optimisation of operations and infrastructure use;
- Intelligent telematics systems development and deployment for interoperable and multimodal scheduling, info, reservation and payment;
- Research on the improvement of energy storage media and devices, batteries, materials, auxiliaries, electric motors, intelligent energy management and control systems in order to optimise fuel consumption in real operating conditions;
- Promotion of the broad and coordinated development and deployment of Intelligent Transport Systems;
- Risk-based design principles of new vessels, following “intelligent concepts and designs”.

Simulation and modeling of transport

7.3.3 Simulation and modelling of transport capacity/efficiency, environmental and system aspects (NEARCTIS, HYCON2, FEHRL, EURNEX).

- Improved human models and virtual testing;
- Motorcycle and pedestrian dummies, relevant simulation and test methods;
- Advanced “human” simulation models, especially related to bio-fidelity and injury prevention capability;
- Measuring and simulating driver behaviour concerning safety and fuel consumption;
- Standardization of methodologies and simulation environments for evaluating new safety systems;
- Development of new modelling tools for real safety simulation;
- Development of simulation tools for impact analysis of new materials;
- Development of simulation tools for integrated safety systems (and not only single elements);
- Research on improved accident prediction models;
- Research on simulation models for the analysis of the sensitivity of the waterborne transport chain to piracy, terrorists, smuggling and stowaways;
- Development of simulation models regarding the demographic development and the entire mobility chain under multiple scenarios;
- Creation of simulation models to link the cause and effect of mobility and transport demand in relationship to land use;

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- Simulation models of the total point-to-point transport chain, so as to quickly determine the most cost effective and rapid combination of transportation modes at any given time and for each operation type;
- Simulation development and optimisation of fully integrated European supply clean systems with a systems approach, addressing the combination of the different transport nodes in terms of costs. Reliability, safety, environmental friendliness, ease of choice, integration, security and market demand are their targeted characteristics;
- Advancing and extending simulation tools and models for improved concept modelling and for higher prediction accuracy of noise and vibration generated by conventional, hybrid and fully electrified road transport, focusing on the topics of uncertainty & variability, sound quality, damping and mid-wavelength phenomena;
- Simulation methodologies covering all electrical aspects are needed for system architecture optimization;
- Develop and apply simulation methods to localize sections with specific problems due to climatic influences (e.g. storm water) and develop respective adapted design procedures;
- Development of new modelling tools for real safety simulation;
- Modelling research on:
 - o cargo spill models;
 - o models and tools for collision / grounding events analysis and impact assessment;
 - o theoretical structural models to provide practical prediction of material fracture in vessel structures under crash conditions.
- Accurate modelling of vehicle sound packaging.
- Advancing and extending simulation tools and models for improved concept modelling and for higher prediction accuracy of noise and vibration generated by conventional, hybrid and fully electrified road transport, focusing on the topics of uncertainty & variability, sound quality, damping and mid-wavelength phenomena;
- Research on the understanding of the relationships between traffic management, driver behaviour, vehicle operation, emissions and environmental impacts. In particular, methods are needed for predicting and managing high pollution episodes in urban areas, the development of appropriate emissions and air quality modelling techniques, and understanding public perception, and hence the acceptability of traffic management and calming schemes;
- Vehicle emissions (and fuel / energy consumption), measurement and modelling;
- Research on modelling and complete life cycle environmental impact assessments of infrastructure (such as port and dredging activities) and vessels, as well as on the modelling of emissions and the resultant spread of pollution in cases of accidents;
- Research on modelling and complete life cycle environmental impact assessments of infrastructure (such as port and dredging activities) and vessels, as well as on the modelling of emissions and the resultant spread of pollution in cases of accidents;
- Enhancement of the comprehension of the links between land use, the transport system and greenhouse gas emissions by both case studies and modeling.

7.3.4 Scientific knowledge for international harmonization regarding safety, operation and CO₂ (FEHRL, HUMANIST, NEARCTIS, ISN, EURNEX).

- Research and rules harmonization on intermodal transport of dangerous goods;
- Research on international transportation of hazardous goods and business models for them;

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- Research on ways to enhance the reliability of global market forecasts, and to provide methods for real-time sharing of information between actors in the supply network;
- Coordination between research, education and training in order for the European industry to attract the best skills and offer life-long training and interesting career opportunities;
- On the operation side, the focus on global research falls in the cost-reduction of the following operations:
 - o Fleet operation;
 - o Maintenance cost;
 - o Product validation;
 - o Product certification;
 - o Single European document (paperless e.g. e-freight/e-customs);
 - o New paradigms for paper free, electronic information exchange in freight transport and logistics;
 - o Improve modal shift to rail;
 - o Seamless travel & modal shift;
 - o Innovative design of services;
 - o Innovative operation methods and tools for better services, increase capacity and faster recovery after incident;
 - o New operational rules for interchange management.
- International cooperation for more efficient transport systems and technical harmonisation;
- Coordination, cooperation and benchmarking with US railroads for best practises exchange;
- Identification of conflicts and abnormalities with regulations and a step-by-step regulations harmonisation towards more cost-effective operations;
- Development of voluntary pilot scheme, its evaluation and a relevant international information network;
- Development and exploitation of internationally agreed risk acceptance criteria and risk-based framework for the establishment of modern and efficient prescriptive and risk-based rules for standard design;

8. References

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- DETRA deliverables 3.1, 2.1, 4.1, 5.2, 6.1
- DETRA – European Transport Research Alliance Ways and Means
- DECOMOBIL D7.1
- ERTRAC road map
- ERRAC road map
- HUMANIST Performance Indicators
- HUMANIST Recommendations based on HUMANIST experience after three years of functioning regarding the activities, organisation and integration approach of a network of excellence
- HUMANIST Business plan
- WATERBORNE road map
- ACARE road map
- Aeronautics and Air Transport - Beyond Vision 2020 (Towards 2050)