



*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 824269.*

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Project Acronym: **infra4Dfuture**  
Project Title: **Infrastructure for the Future**  
Project Number: **824269**  
Topic: **MG-2-4-2018 – Coordinating national efforts in modernizing transport infrastructure and provide innovative mobility services**  
Type of Action: **Coordination and Support Action (CSA)**

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## **D2.2 – Effective collaborative structures and schemes for cross-modal, transnational information transfer and cross-fertilisation between innovation programmes and initiatives Nr.1**

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*Version 1.0*

<b>Deliverable:</b>	D2.2– Effective collaborative structures and schemes for cross-modal, transnational information transfer and cross-fertilisation between innovation programmes and initiatives Nr.1
<b>Work Package:</b>	WP2: Developing structures enabling transnational coordination of existing and future innovation programmes
<b>Due Date:</b>	30/11/2019 (M14)
<b>Submission Date:</b>	31/01/2020
<b>Start Date of Project:</b>	01/10/2018
<b>Duration of Project:</b>	24 Months
<b>Organisation Responsible of Deliverable:</b>	Bundesanstalt für Straßenwesen (BASt)
<b>Version:</b>	1.0
<b>Status:</b>	Final
<b>Author name(s):</b>	Bernard Gyergyay (BASt) Ursula Blume (BASt)
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<b>Nature:</b>	<input checked="" type="checkbox"/> R – Report <input type="checkbox"/> P – Prototype <input type="checkbox"/> D – Demonstrator <input type="checkbox"/> O - Other
<b>Dissemination level:</b>	<input checked="" type="checkbox"/> PU - Public <input type="checkbox"/> CO - Confidential, only for members of the consortium (including the Commission) <input type="checkbox"/> RE - Restricted to a group specified by the consortium (including the Commission Services)

## CONTENTS

1	Introduction .....	4
2	The i4Df cross-modal and transnational portfolio of existing and future innovation and research programmes and initiatives .....	5
3	Identification of innovation and research programmes and initiatives .....	7
3.1	EU-regional events (MS10) .....	7
3.2	TRIMIS .....	7
3.3	STRIA 2019 (not published yet) .....	8
3.4	Horizon Europe .....	8
3.5	Connecting Europe Facility .....	9
3.6	Next steps for the identification innovation and research programmes and initiatives ..	9
4	Methodological approach for portfolio analysis .....	10
4.1	Thematic links with eight i4Df IFAs .....	10
4.2	Identification of characteristics to describe and compare identified programmes and initiatives .....	10
4.3	Next steps methodological approach for the portfolio analysis .....	11
5	Best practice examples of existing models for collaboration and the transfer of results .	12
6	Next Steps.....	13
	Annex A: Overview of identified innovation and research programmes .....	14
	Annex B: Regional Outreach Events Reports .....	15
	Annex C: Matching 11 selected programmes identified in the TRIMIS database with i4Df Innovation Focus Areas.....	40
	Annex D: Matching Horizon Europe with i4Df Innovation Focus Areas .....	57

## 1 Introduction

The overall aim of this deliverable is to set up a structure for a cross-modal and transnational portfolio of existing and future innovation and research programmes and initiatives. This portfolio can be used by the Innovation Focus Area (IFA) Collaboration Groups of the National Transport Infrastructure Authorities (NTIAs) (see D1.3 for further guidance on NTIA IFA Collaboration Groups), created in the infra4Dfuture project, to determine an appropriate generic level for potential demand driven coordination and collaboration activities, such as:

- Alignment of national innovation agendas on national networks;
- Joint research and innovation activities across borders, sectors and modes;
- And yet to be determined other activities.

In order to achieve this aim, the following objectives will be completed in D2.2 and D2.3:

- a) Explanation of the portfolio and other key terms;
- b) Identify suitable innovation and research programmes and initiatives to be included in the portfolio;
- c) Develop a suitable methodology to conduct a portfolio analysis with the following foci:
  - i. Development of the thematic links between identified programmes and initiatives, and the eight i4Df IFAs (s. D1.2);
  - ii. Identification of characteristics to describe and compare identified programmes and initiatives
- d) The completion of the portfolio analysis and the development of suitable recommendations for the operationalisation of the IFA collaboration groups.
- e) Provide best practice examples of existing models for collaboration and the transfer of results applied by the identified programmes and initiatives.

This deliverable D2.2 suggests approaches for objectives a), b) and c) to the i4Df consortium and the key stakeholders of this initiative. Objective d) and e) will be addressed at the later stage in D2.3 (Month 18/April 2020) once further input and feedback was gathered from the i4Df consortium, key stakeholders and IFA collaboration groups as part of the 2<sup>nd</sup> Expert Workshop (a.k.a. “Pre-Launch Event”, MS11)<sup>1</sup>. For this reason this deliverable is marked as “under consultation” until the completion of the 2<sup>nd</sup> Expert Workshop (MS11).

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<sup>1</sup> COVID-19 has proven to be a game changer to the anticipated process for delivery of this deliverable. Two physical events, the 2<sup>nd</sup> Expert Workshop and the 4<sup>th</sup> Stakeholder Conference, that were planned for spring 2020 with the objective to capture final input from the stakeholder groups, had to be cancelled and replaced by digital solutions. Please refer to D2.3 “Effective collaborative structures and schemes for cross-modal, transnational information transfer and cross-fertilisation between innovation programmes and initiatives – Nr.2” for a detailed description of the adapted methodology used to complete this task.

## 2 The i4Df cross-modal and transnational portfolio of existing and future innovation and research programmes and initiatives

The i4Df cross-modal and transnational portfolio of existing and future innovation and research programmes and initiatives, abbreviated as “the i4Df portfolio of innovation programmes”, is an attempt to provide a suitable tool that can be used by IFA collaboration groups to determine the most appropriate generic level for demand driven coordination and collaboration activities. Due to the difference in each of the eight IFA innovation ecosystems, each IFA collaboration group has a unique thematic focus and ecosystem setup. Hence, it is neither possible nor wanted to develop and suggest a “one-size fits all” approach for coordination and collaboration activities of the IFAs. The i4Df portfolio of innovation programmes rather aims to illustrate the multitude of the different cooperation and collaboration that currently exist in Europe and match them thematically with the eight IFAs. This illustration can be used by the IFA collaboration groups for inspiration to set up the most suitable approach to the unique setup of their IFA collaboration ecosystem.

For further clarification the key terms for the i4Df portfolio of innovation programmes are explained as follows:

- i. Cross-Modal: i4Df is an initiative that aims to identify common research and innovation needs across the modes. This is not to be confused with multi-modal, which is a research and innovation theme in its own focusing on the organisational interchanges between modes. In order to identify cross-modal research themes/challenges, the i4Df portfolio of innovation programmes needs to be open to all transport modes, incl. road, rail, waterways, ports and airports.
- ii. Transnational: the i4Df portfolio needs to look equally at national programmes and international programmes in order to enable the potential alignment of national innovation agendas and joint transnational research and innovation activities.
- iii. Innovation and research programmes: the i4Df portfolio needs to identify innovation and research programmes that are suitable for the needs of the NTIAs. Research and innovation programmes that show no added benefit to NTIAs will be excluded from the portfolio.
- iv. Current and future research and innovation programmes: The European landscape of research and innovation programmes is very diverse and changing regularly. Hence, it is necessary to regularly update the portfolio to ensure that it becomes a “rolling portfolio”. This is especially relevant for the Horizon Europe activities that are currently being developed.

The end-users of this portfolio will be the eight IFA collaboration groups. However, it needs to be noted that at the time of the submission of the deliverable the IFA collaboration groups are in very early stages of initiation and hence are not able to review the suggested portfolio structure and approach. In order to ensure the usability of the portfolio, the views of the IFA

collaboration groups on the suggested approach will be collected at a later stage and during the 2<sup>nd</sup> Expert Workshop (MS 11)<sup>2</sup>.

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<sup>2</sup> Events cancelled due to COVID-19. Please refer to D2.3 for a detailed description of the adapted methodology used to complete this task.

## 3 Identification of innovation and research programmes and initiatives

Annex A provides an overview of identified innovation and research programmes and initiatives, which were extracted from the following sources:

### 3.1 EU-regional events (MS10)

In autumn 2019, the following four regional outreach events were organised by the i4Df consortium:

- Riga: 10/11 September 2019; host: LVC/LV
- Paris: 30 September/1 October 2019; host: MEME/FR
- Warsaw: 16 October 2019; host: MI/PL
- Thessaloniki: 5/6 November 2019; host: CERTH/HIT/GR

The thematic and strategic preparation and the overall organisation, i.e. the definition of the aim and the expected results of these events, the distribution of the countries that are inside the consortium respectively the neighbouring countries to the four hosting partners, were prepared by the leader of WP2 (BAST) in close cooperation with WP1 (RWS). BAST and RWS also assisted the hosts in the conduction of the events. At each of the four events, at least two representatives both from RWS and from BAST have presented the aim of the infra4Dfuture project, the results achieved so far and the next steps that will be taken.

The reports from each regional outreach event are summarised in a workshop report that are attached in annex B of this deliverable. In summary, the following results can be noted in the context of this deliverable from the events:

- Through the events, the structure of eight IFAs was confirmed by regional stakeholders and a regional feedback for the eight topics was gathered.
- At the events, additional research and innovation programmes were collected that will be included for analysis in D2.3. For example, additional information was collected from the following research and innovation programmes: Baltic Road Association ([www.balticroads.org](http://www.balticroads.org)), NordFoU ([www.nordfou.org](http://www.nordfou.org)), FEREC (<https://fondation-ferec.fr/>) and IDRRIM ([www.idrrim.com](http://www.idrrim.com)).

### 3.2 TRIMIS

The Transport Research and Innovation Monitoring and Information System (TRIMIS) monitors the implementation and effectiveness of the roadmaps developed by the Strategic Transport Research and Innovation Agenda (STRIA) in 2017. TRIMIS analyses technology trends, research and innovation capacities and developments in the European transport sector, providing open-access information. In the database (<https://trimis.ec.europa.eu/>) of programmes related to transport infrastructure currently 81 programmes are listed. After an initial screening (see Annex C), 11 programmes from the database were considered relevant and selected for further review in D2.3 for potential addition into the i4Df portfolio of innovation and research programmes.

### 3.3 STRIA 2019 (not published yet)

As part of the First Mobility Package of the Commission of 31 May 2017, the European Commission prepared a Staff Working Document<sup>3</sup> which focused on the definition of a Strategic Transport Research and Innovation Agenda (STRIA). That document includes a forward-looking agenda for research and innovation in transport, in particular addressing seven priority areas in the form of roadmaps.

As part of these roadmaps, the first STRIA roadmap on Transport Infrastructure published in 2017 assessed the requirements for changes to infrastructure to meet the environmental policy objectives and, for this purpose, sought to identify the areas where the next generation of research and innovation are likely to be of greatest benefit. This roadmap focused on the areas of governance; pricing, taxation and finance; intermodality, interoperability and integration of transport systems; life cycle optimisation; and infrastructure operation and digitalisation.

During 2019, the European Commission has updated several STRIA Roadmaps, transport infrastructure being one of them. While during 2016-2017 the development of the first STRIA Roadmap on Transport Infrastructure was mainly concerned with decarbonization as the key goal, this updated version shows a wider approach. Decarbonization is still an objective, but other aspects are herein being considered too, such as a) governance; b) Life cycle and asset management; c) Financing, pricing and charging; d) Technology and digitalisation; e) Multimodality, interoperability and interconnectivity; f) Safety and security; g) Sustainability, environment and resilience; and h) Logistics. A total number of 101 actions are described for the above themes, covering policy, management and technological actions.

The final version of the STRIA 2019 Infrastructure Roadmap is not published yet, but a draft version was given to the i4Df consortium for review as part of a wider consultation process.

### 3.4 Horizon Europe

The purpose of the document “Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe” (European Commission, 2019)<sup>4</sup> is to inform and stimulate a co-design process that will prepare the first Strategic Plan for Horizon Europe, the European Union Framework Programme for Research and Innovation 2021 – 2027. The document presents six focus clusters for Horizon Europe, which are currently going through a wider consultation process. Within the context of i4Df Cluster 4, ‘Digital, Industry and Space’, Cluster 5, ‘Climate, Energy and Mobility’ will be considered for further analysis, and Cluster 6, ‘Food, Bioeconomy, Natural Resources, Agriculture and Environment’. The result of matching the initial Horizon Europe structure to the i4Df IFAs can be found in Annex D. From this comparison it can be seen that IFAs 2.1 “Decarbonisation of Infrastructure

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<sup>3</sup> Commission Staff Working Document. Towards clean, competitive and connected mobility: the contribution of Transport Research and Innovation to the Mobility Package. 2017  
<https://ec.europa.eu/transport/sites/transport/files/swd20170223-transportresearchandinnovationtomobilitypackage.pdf>

<sup>4</sup> Available on: [https://ec.europa.eu/research/pdf/horizon-europe/ec\\_rtd\\_orientations-towards-the-strategic-planning.pdf](https://ec.europa.eu/research/pdf/horizon-europe/ec_rtd_orientations-towards-the-strategic-planning.pdf)



Management”, 3.1 “Smart Data and Information Ecosystem for Accommodating Automated and Connected Transport” and 3.2 “Information Provision for Process Optimisation in Infrastructure Management” have the most matches and IFAs in Capability 1 “Infrastructure Optimally Meeting End User Needs” the least.

### 3.5 Connecting Europe Facility

The Multi-Annual Work Programme for financial assistance in the field of Connecting Europe Facility (CEF) - Transport sector for the period 2014-2020 - provides an overview of specific objectives that are used as criteria for funding. The 15 specific objectives in the 2014-2020 programme will be considered in the context of i4Df.

### 3.6 Next steps for the identification innovation and research programmes and initiatives

In summary it can be said that i4Df is not starting from a blank sheet to provide an overview of programmes and initiatives; the STRIA and TRIMIS activities have contributed significantly to the identification and monitoring of the innovation and research programmes in the field of transport infrastructure. However, in the context of i4Df an additional identification process is still required in order ensure that identified programmes match the needs of the NTIAs and their ambition to collaborate. These needs are described in more detail in D1.2 “Joint vision on transport infrastructure innovation until 2040” according the structure of capabilities and their Innovation Focus Areas”.

Annex A provides an overview of all the innovation and research programmes that will be considered for an analysis within the i4Df portfolio of innovation and research programmes. Through the consultation process that will be finalised at the 2<sup>nd</sup> Expert Workshop (MS11; a.k.a “Pre-launch Event” in 16-17 March 2020 in Malmö/Copenhagen)<sup>5</sup>, it is expected that additional programmes will be identified, especially national programmes that could be used for cross-fertilisation within the IFA collaboration groups.

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<sup>5</sup> Events cancelled due to COVID-19. Events cancelled due to COVID-19. Please refer to D2.3 for a detailed description of the adapted methodology used to complete this task.

## 4 Methodological approach for portfolio analysis

Even though there is a wide range of literature available on the evaluation of the innovation and research programmes), there is no concept available that exactly focuses on the context of the i4Df approach and the needs of the NTIAs and their ambition to collaborate. The i4Df portfolio of innovation programme is an attempt to provide a suitable tool that can be used by IFA collaboration groups to determine the most appropriate generic level for demand driven coordination and collaboration activities and match them thematically according to the eight IFAs. Hence, the following aspects are suggested for consideration in the methodological approach for the portfolio analysis.

### 4.1 Thematic links with eight i4Df IFAs

Deliverable 1.2 “Joint vision on transport infrastructure innovation until 2040” defines the eight innovation focus areas for innovation and implementation relevant to the joint infrastructure capabilities that provide the thematic structure for the eight IFA collaboration groups:

#### **Capability 1: Infrastructure optimally meeting end user needs**

- 1.1 Innovation Focus Area: Network performance
- 1.2 Innovation Focus Area: Integrated infrastructure network management
- 1.3 Innovation Focus Area: Responsible and innovative procurement and finance

#### **Capability 2: Infrastructure meeting environmental and social sustainability needs**

- 2.1 Innovation Focus Area: Decarbonisation of infrastructure management
- 2.2 Innovation Focus Area: Preserving the environment
- 2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

#### **Capability 3: Infrastructure achieving added value from digitalisation**

- 3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport
- 3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

These eight IFAs provide a core element of the i4Df cooperation mechanism. Hence, it is suggested that all of the identified innovation and research projects will be screened according to their thematic foci and overlaps with the eight i4Df IFAs.

### 4.2 Identification of characteristics to describe and compare identified programmes and initiatives

The i4Df cooperation mechanism describes the mode of collaboration of the different stakeholders and the collaboration inside the IFAs as well as the interaction between the IFAs. It is not finalised and agreed upon by the consortium members at the stage of writing this deliverable. The finalisation and the endorsement by the i4Df stakeholders was completed at

the third i4Df stakeholder conference on 12 December 2019 and the results of the event are still being processed. Hence it is not possible at this stage to determine the exact “added value” of the identified innovation and research programmes to the cooperation mechanism. However, through the previous stakeholder conferences and the regional outreach events the following aspects were identified as important characteristics for the i4Df cooperation mechanism to ensure that it provides “added value to existing structures and programmes”:

- **LIGHT** – as a background structure
- **FLEXIBLE** – to accommodate relevant developments
- **OPEN** – to accommodate relevant new stakeholders and programmes

Based on the above requirements for the “added value” to the cooperation mechanism the following qualitative criteria are suggested for the evaluation of the identified research and innovation programmes:

- **LIGHT** – Indication about the size and extent of the background structure of the programme
- **FLEXIBLE** – The ability to accommodate relevant developments in changing themes and cooperation approaches
- **OPEN** – Ability to accommodate relevant new stakeholders (e.g. from different modes) and programmes
- **TRL** – Which TRL does the programme focus on?

These characteristics will be critically reviewed by the IFA collaboration groups during the 2nd Expert Workshop (MS11) and fine-tuned for the use in D2.3. These characteristics will enable participants of IFA collaboration groups to develop a common terminology to describe their needs and expectations for their collaboration activities.

#### 4.3 Next steps methodological approach for the portfolio analysis

During the consultation process, the above identification of thematic links, existing models for cooperation and qualitative criteria will be fine-tuned in order to provide through the portfolio analysis an indication of the added value of the identified programmes to the cooperation mechanism. The IFA collaboration groups will extend the list of relevant programmes with their own national programmes.

## **5 Best practice examples of existing models for collaboration and the transfer of results**

From the identified programmes and initiatives (see Annex A), several best practice examples of existing models for collaboration and the transfer of results can be extracted to provide inspiration for the activities of IFA collaboration groups. The scope of the best practice examples includes aspects such as transfer of intellectual property rights, exchange of knowledge and setting up joint research activities. These best practice examples will be described in detail in D2.3.

## 6 Next Steps

The consultation process in order to finalise the portfolio analysis as part of D2.3 will be conducted as follows:

- After 31 January 2020: A structured consultation process within the i4Df consortium and the eight IFA collaboration groups during the 2<sup>nd</sup> Expert Workshop (MS11)<sup>6</sup>;
- Fourth Stakeholder Conference (MS4) taking place at the TRA 2020 in Helsinki<sup>7</sup>, Finland.

The consultation will focus on the following aspects:

- Identification of the suitable transnational and national innovation and research programmes;
- Methodological approach of the portfolio;
- Identification of best practice examples of models for collaboration and the transfer of results;
- Results from the portfolio analysis.

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<sup>6 7</sup>: Events cancelled due to COVID-19. Please refer to D2.3 for a detailed description of the adapted methodology used to complete this task.

## Annex A: Overview of identified innovation and research programmes

- CEDR (Transnational)
- CoT - City of Things - smart cities and municipalities Flanders Innovation and Entrepreneurship (VLAIO)
- TakeOff Federal Ministry for Transport, Innovation and Technology (BMVIT)
- Shift2Rail
- MOTF - Mobility of the Future (AT)
- FFI - Strategic Vehicle Research and Innovation (SE)
- Sustainable transportation (CH)
- NordFoU (Nordic Countries)
- BRA - Baltic Road Association (Baltic Countries)
- D-A-CH (DE, AT, CH)
- Horizon Europe
- Connecting Europe Facility
- FEREC (FR)
- IDRRIM (FR)

## Annex B: Regional Outreach Events Reports



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**i4Df – outreach4North event  
10 – 11 September 2019, Jūrmala/Latvia**

**Micro hackathon results – team reports**

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## Introduction

infra4Dfuture project outreach4North event was held in Jūrmala, Latvia on 10<sup>th</sup> and 11<sup>th</sup> September 2019. As an interactive part of the event, micro hackathon was organised and carried out.

To have minds sharp and discussions dynamic, it was decided that the hackathon will be held just after the morning's plenary session and coffee break but team presentations would be held after the lunch break.

To make the hackathon spirit work, competition is needed. To achieve this, all participants were divided into three groups and each group was given a set of two capabilities from the draft paper "Joint vision on transport infrastructure innovation until 2040" (Deliverable D1.2, version 2, 1<sup>st</sup> August 2019). The following groups were set up:

### team#Red

**Capability 1: Infrastructure optimally meeting end user needs &**

**Capability 2: Infrastructure meeting environmental and social sustainability needs**

Speaker: Lyke Bosma (RWS/NL)

### team#Green

**Capability 2: Infrastructure meeting environmental and social sustainability needs &**

**Capability 3: Infrastructure achieving added value from digitalisation**

Speaker: Mārtiņš Dambergs (LVC/LV)

### team#Blue

**Capability 3: Infrastructure achieving added value from digitalisation &**

**Capability 1: Infrastructure optimally meeting end user needs &**

Speaker: Jānis Baumanis (LVC/LV)

Overlapping capabilities are a fundamental precondition for this way of competition. Teams had to organise themselves, meaning that event organisers did not interfere with the workings and decisions of team members. Total freedom was given (to stay indoors or to work on the beach, to have one speaker or whole group as presenters of the results) to the groups and only one question was asked: **Solutions to mobility challenges in the Northern Europe. Looking through the prism of three i4Df capabilities.**

After a short introduction by the organisers, the teams discussed for approximately 1 hour and 40 minute, followed by a lunch break and a final presentation of the results of each team (10 minutes). The jury, consisting of five project partners, assessed these presentations and made their decision on the winning team.

Meanwhile all participants had a chance to listen to the presentation of professor Roberts Kilis on "Future of infrastructure from the point of view of society development". It was followed by the jury's announcement of the winner (i.e. **team#Green**) and a closing ceremony of the event.



In this report, the findings are grouped to the structure applied to the reports of the Western and Southern outreach event to allow a structured evaluation of the results of all outreach events. The questions that were raised there are the following:

- What should IFAs cooperate on?
- How should they cooperate?
- What are benefits and challenges to cooperation?
- How can challenges be overcome?

### team#Red

#### **Capability 1: Infrastructure optimally meeting user needs &**

#### **Capability 2: Infrastructure meeting environmental and social sustainability needs**

Speaker: Lyke Bosma, RWS

#### ***What should IFAs cooperate on?***

The team started out with a discussion on capability 1 and first identified the following major mobility challenges:

- Safety/speed.
- Accessibility, especially for people with special needs (such as the elderly and remote areas).
- Multimodality (bus, rail, regional buses, tram, bicycle, car, etc.).
- Different situations in the different countries of the North, and difference between urban – non-urban areas.

Furthermore, the team formulated what they believed were the basic needs of the end users: a safe, connected, accessible and sustainable infrastructure for optimal (fast and comfortable) mobility.

Although the team started out with capability 1, it was soon realized that sustainability (social and environmental) is a substantial part of these user needs. To meet these needs, a whole range of possibilities was given by the team, in which a difference was noted between urban mobility, urban to urban mobility, non-urban mobility and transnational mobility. For example, it was expressed that travels between Latvian towns normally the car is used, but for travels between Riga to Vilnius the bus is the preferred option - this option was not even considered for transport within Latvia.

The team agreed that for sustainable mobility in the future it will be necessary to rely more on public transport, especially in urban areas. But currently there are many limitations that prevent users from considering public transport, e.g.:

- Behavioral: people are happy to use their car (status and freedom);
- Lack of information: it takes time to figure out the best way to use the public transport;

- Connectivity: the connectivity between different modes of public transport is not considered so far;
- Safety: use of public bicycles is unsafe.

In depth the team came up with three steps to provide a change to optimize the user needs now and in the future:

1. Improve the current situation of the public transport: better planning, more interconnectivity, easier access to real-time information. In this way, public transport may be an alternative to the use of cars.
2. Adapt the existing infrastructure: to suit the needs also in the future. For example, a red painted stretch on the road clearly marks this area for bikers. Circulation of the traffic in one direction will allow to dedicate one lane to buses only. Another option is to give priority to bikers and buses at traffic lights. It is important to state that no new infrastructure neither should be built nor is necessary for these measures, as this is costly.
3. Change the behavior of the users: incentives/disincentives, such as high parking fees or restricted access for cars. Also education should play a role, as it should become normal to consider different mobility options than just the car.

The team also came to the conclusion that mobility should change into service thinking. Parallel to these striven behavioral changes, psychologists should come in handy to provide advice on coming about these changes.

### team#Green

#### **Capability 2: Infrastructure meeting environmental and social sustainability needs &**

#### **Capability 3: Infrastructure achieving added value from digitalisation**

Speaker: Mārtiņš Dambergs, LVC

#### ***What should IFAs cooperate on?***

#### **Capability 2: Infrastructure meeting environmental and social sustainability needs**

#### ***Innovation Focus Area 2.1: Decarbonisation of infrastructure management***

The following initiatives may be considered to reduce CO<sub>2</sub> emissions:

- Switching from fossil fuels to biofuels.
- Replacing of limestone with fly-ash or slag with the aim to reduce CO<sub>2</sub> emissions (experience from SE).
- Further introduction of special technologies for capturing CO<sub>2</sub> in concrete production (experience from SE).
- Promotion of the use of warm asphalt mixes instead of hot mixes to reduce the heating.
- Changing the approach to lifetime of structures with the aim to prolong overall lifetime and periods between needed maintenance measures.

- Promotion of recycling of materials from old structures.
- Promotion of the use of electrical equipment in construction works and e.g. quarries.
- Bonuses to contractors if they prove they may reduce CO<sub>2</sub> emissions below certain levels (experience from SE).
- Infrastructure managers should know and accept that such measures may cost more.

### ***Innovation Focus Area 2.2: Preserving the environment***

The following initiatives may be considered:

- Much may be accomplished with better planning and better designs.
- In terms of wildlife, animal habitats should be preserved and biodiversity of plants (problem with invasive species) along roadsides should be taken into account.
- In terms of human beings, noise and its mitigation measures should be considered.
- Finally, balance of the needs of human beings, needs of wildlife and funding capacity should be considered.

### ***Innovation Focus Area 2.3: Integrating multi-layer networks and nodes***

Immediate solutions were not proposed, but following challenges were discussed.

#### ***How IFAs should cooperate?***

At present, there are many players/stakeholders (politicians, infrastructure managers, local governments, individuals, etc.) in the field whose interests have to be taken into account. Therefore e.g. experience with single transport administrations (Se, FI, NO) should be studied further (their benefits and disadvantages).

#### ***How can challenges be overcome?***

- Though it might sound controversial, less democratic procedures in decision making might require less time.
- At the same time, the reduction of human factors in decision making also has to be considered. Automated collection of data and digitalisation of planning in decision making may be shown as a proof that decisions on priorities are unbiased.

### **Capability 3: Infrastructure achieving added value from digitalisation**

#### ***What should IFAs cooperate on?***

#### ***Innovation Focus Area 3.1: Smart data and information ecosystem for accommodating automated and connected transport***

The following items were discussed:

- Some elements of the above-mentioned ecosystem already exist, e.g. the EU regulations on free provision of road safety related information, truck parking information, multi-modal transport information, etc.,
- Though the development until 2040 is discussed, new developments in terms of IT technology will come much faster, therefore there is no possibility to make predictions for far future,
- Means of communication from vehicle to vehicle and from vehicle to infrastructure are developing fast,

- Faster communication technologies (5G or similar) will greatly contribute to the above-mentioned communication,
- Norway is developing a “digital twin” of their road infrastructure in order to follow infrastructure related information in real time. Sweden is focused on real time information (e.g. information from vehicles to infrastructure operators on possible ice on roads),
- Some risks may appear that would be related to: ownership of information (who exactly would own the data provided by vehicles), IT security, privacy of individuals,
- Nobody is discussing the increase of energy consumption needed for all new means and pieces of equipment for communication.

### ***Innovation Focus Area 3.2: Information provision for process optimisation in infrastructure management***

The following items were discussed:

- The present infrastructure comes from different ages and equipment for collecting information also differs. Problem may arise how to synchronise digital elements with physical components of infrastructure,
- Automation of collection of information about the condition of infrastructure, which will be enabled by new devices and new means of communication, will greatly contribute to optimised infrastructure management,
- In further future the use of Internet of Things and artificial intelligence will contribute to infrastructure management even to a greater extent.

#### **team#Blue**

#### **Capability 1: Infrastructure optimally meeting user needs**

#### **Capability 3: Infrastructure achieving added value from digitalisation**

Speaker: Jānis Baumanis, LVC

#### **What should IFAs cooperate on?**

There is a large number of mobility problems specific for Northern Europe:

- Rural connectivity:

Northern Europe differs from rest of Europe by its size and low population density which means that for the society, costs for interregional mobility is much higher than in rest of Europe. To enable sustainable region-wide development rural connectivity is essential.

- Unsustainable urbanisation:

The lack of services or job opportunities causes rural-urban migration, which is more likely to happen in least populated regions if mobility services or infrastructure is not sufficient and easily accessible. On the other hand, unsustainable urbanisation puts tremendous strain on already existing public infrastructure.

- Cost of infrastructure:

Large distances between regional centres and scarce population demands substantial infrastructure network which is more costly to build and maintain and the rate of return on capital and the amount of people it directly benefits is much lower than if the money were spent on urban or inter-urban transport infrastructure.

- Lack of information about mobility alternatives:

There is a public unawareness of possible alternative means of transportation that is caused by incoherence and lack of intermodality between different transport systems. Currently, all mobility options are not forged together and are not seen as one service. Using a different perspective would help both individual and commercial user in finding the benefits.

Possible solutions (not in priority order):

- Open data:

Advances in digitalization of processes have allowed to establish an open data concept. In the transportation sector this is the sharing of critical data such as weather information, traffic flow, location of emergency services etc. Digitalisation enables to collect large amounts of data from for example utility vehicles to be used in a large variety. Data sharing can lead to an optimization of processes and creation of new digital tools for enhanced mobility solutions.

- Mobility as a service (MAAS):

MAAS is emerging approach of integration of various forms of transportation services into homogenous mobility service. Brining MAAS approach and services not only to urban, but also to rural regions would give great benefit to population by allowing to using existing infrastructure network and mobility options more efficiently, resulting in a decreased need of construction of new infrastructure.

- “Last mile” principle:

Currently, the “Last mile” principle is associated with transporting goods and people to their destination by taxi or parcel service, but this only results in increased congestion levels in urban areas. Therefore, it is necessary to elevate this principle to another level, by providing alternatives for car usage for both inhabitants and tourists would be bike sharing, or for goods transportation the usage of drones. For this it is necessary to connecting the missing links on the last stretch of journey.

- Shift to sustainable public transportation:

Public transportation is seen as key to a sustainable transport system. A shift to it is necessary because it addresses challenges connected to economy, environment and congestion in a more sustainable way compared to other travel modes. A crucial task to encourage people to use public transport is the integration of all forms of public transport and increased regional availability.

- Integrated services (public – freight):

Integration between private and commercial transport could optimise costs of public mobility in remote regions by not providing and maintaining inefficient public transportation routes but instead by creating demand-responsive transport system where individual users can use freight transport as passenger by demand. For example, postal service transport will anyway operate in a region, but by linking it to individual traveller it could decrease cost of mobility as it is much cheaper for government to compensate expenditure for commercial transport owner that to operate costly public transport system.

- Predictive maintenance:

Operational and maintenance costs for infrastructure are ever increasing with more demand for uninterrupted mobility. In order to ensure this, it is vital to implement a predictive and pro-active system to anticipate possible problems and highlight weak spots in the transport network to minimise the possibility of a costly sudden breakdown. The key for implementing predictive maintenance is the use of open data and big data that will generate solutions to typical problems such as maximizing intervals between scheduled repair works.

### ***What are the benefits and challenges to cooperation?***

Infrastructure synergies:

As mentioned before, large transport infrastructure projects are expensive, therefore it is necessary to create synergies with other types of infrastructures such as energy or telecommunication sectors to create shared networks and grids. Simultaneous construction of multiple infrastructure types in one corridor or by sharing physical components of structures allows to developing projects in a more efficient manner compared to a separate construction.



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## **i4Df – Regional Outreach Event West 30 Sep – 01 Oct 2019, Paris/France**

### **Workshop Report**

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## Introduction

The regional outreach event “West” was held in Paris, France on 30<sup>th</sup> September and 1<sup>st</sup> October. As an interactive part of the event, three workshops were organised in the morning of 1<sup>st</sup> October. This document reports on the outcome of the workshops.

Based on the infrastructure capabilities identified in the i4Df deliverable “D1.2 – Joint vision on transport infrastructure innovation until 2040” the following three break-out groups were set up with a moderator and rapporteur each:

### **Capability 1: Infrastructure optimally meeting end user needs**

Moderator: Richard van der Elburg (Rijkswaterstaat, NL)

Rapporteur: Marie-Therese Goux (Ministère de la Transition écologique et solidaire, FR)

### **Capability 2: Infrastructure meeting environmental and social sustainability needs**

Moderator: Thibault Prevost (Ministère de la Transition écologique et solidaire, FR)

Rapporteur: Claude Rospars (IREX, FR)

### **Capability 3: Infrastructure achieving added value from digitalisation**

Moderator: Bernard Gyergyay (BAST, DE)

Rapporteur: Brice Delaporte (Routes de France, FR)

After a short introduction by representatives of the i4Df consortium, the groups had 90 minutes to discuss the following aspects and others in relation to the IFA ecosystems in each capability:

- What should IFAs cooperate on?
- How should they cooperate?
- What are benefits and challenges to cooperation?
- How can challenges be overcome?

After the break-out workshops were completed, the moderator or rapporteur from each group had a chance to present the results from each group to the auditorium.

## Capability 1: Infrastructure optimally meeting end user needs

Moderator: Richard van der Elburg (RWS, NL)

Rapporteur: Marie-Therese Goux (Ministère de la Transition écologique et solidaire, FR)

Participants:

The discussion of the group mainly focussed on the following questions:

### What should IFAs cooperate on?

The integration of new technologies in the infrastructure construction, maintenance and management such as artificial intelligence, but also new materials, new processes and tools such as BIM to allow better performances and lower costs.

Anticipation of the consequences of platooning, automated vehicles on road construction and maintenance, on communication between roads and vehicles. For platooning, questions such as loads on bridges, safety of the access and exits from motorways are topics which are to be studied with vehicle manufactures.

Further, cooperation activities could focus on multimodal complementarity, multimodal nodes, performance indicators for roads, user information and approaches to minimise disruption during maintenance.

### What are the challenges to be overcome for cooperation?

The following challenges need to be overcome to facilitate successful cooperation:

- Very different needs of the NTIAs across Europe;
- Different interests between stakeholders, NTIAs and companies;
- National procurement law and regulation that makes it difficult for innovation to cross the border;
- Resistance to change and high risks linked to the implementation of innovations;
- High costs for NTIAs to implement European regulations and directives (e.g. for tunnels).

### How to cooperate and how to overcome challenges?

The following suggestions were made to overcome identified challenges:

- Reduce the silos between the modes to enable better cooperation;
- Enable bottom-up support between NTIAs and experts;
- Additional efforts to convince decision makers to support research and innovation;
- Improved dissemination and sharing of good experiences and innovations through websites and conferences;

- Not only focus on the long-term, but also the short-term needs;
- Fund for test tracks.

## Capability 2: Infrastructure meeting environmental and social sustainability needs

Moderator: Thibault Prevost (Ministère de la Transition écologique et solidaire)

Rapporteur: Claude Rospars (IREX)

Participants:

- Marion Bost (Ifsttar, FR)
- François Chaignon (Routes de France, FR)
- Christophe Chevalier (Ifsttar, FR)
- Thibault Prevost (MTES, FR)
- Jean-Claude Roffe (Routes de France, FR)
- Claude Rospars (IREX, FR)
- Isabelle Schnell-Lortet (Renault Trucks / Volvo, FR)
- François Toutlemonde (Ifsttar, FR)

The discussion of the group mainly focussed on the following topics that require further cooperation activities:

### **Sustainability, risk and safety**

National policies and scientific/technical expertise about natural hazards (e.g. rockfalls, landslides) vary significantly between countries. There is a need to upgrade and develop common scientific and engineering approaches as the potential basis for future European standards in the field.

Regarding construction safety issues, Eurocodes are being revised but their upgrade relies on incomplete scientific results (in the civil engineering domain). There is the need to boost scientific expertise in the evaluation of infrastructures to provide better grounded rules for Eurocodes.

For large, massive construction works (e.g. large underground stations), current European standards (e.g. Eurocode EC2) are insufficient. There is a need to boost research in the field and translate scientific knowledge into better standards.

### **Road: evolution and degradation of pavements**

Asphalt degradation impacts vehicle efficiency and fuel consumption. There is a need for mitigating pavement degradation through sound road asset management practices.

Load control of trucks and the development of performance-based standards for trucks are key to future road asset management

Also, there is a need to develop proper rail/waterway connections/platforms to make rail/waterway freight competitive on a European level. For example, better intermodal platforms outside large cities could be set up.

### **Production/provision of renewable energy by road**

There is an urgent need to develop a proper network of charging stations for electric vehicles across Europe (and therefore promote infrastructure adaptations).

### **Infrastructure, climate change and big cities**

Climate change and urban heat effect: there is a need for better collaboration between architects, urban planners, civil engineers and construction experts to address the challenge. In particular, more research and expertise are needed on city greening solutions and adapted infrastructures (making the most of rain water, integrating partial vegetation etc.).

### Capability 3: Infrastructure achieving added value from digitalisation

Moderator: Bernard Gyergyay (BASt, DE)

Rapporteur: Brice Delaporte (Routes de France, FR)

Participants:

- Diego Ramirez (Eiffage, FR)
- Frederic Bourquin (IFSTTAR, FR)
- Philippe Gotteland (FNTP, FR)
- Maria NELSSON (Trafikverket, SE)
- James Gilbert (Indura, FR)
- Ali Daouadji (INSA Lyon, FR)
- João Figueiredo (IP, PT)

The discussion of the group mainly focussed on the following questions:

#### **What should IFAs cooperate on?**

The discussion focussed on how digitalisation can improve methods for asset management. This included topics such as digital twins (e.g. BIM models), the use of big data, AI and cross-sectoral digital transition.

#### **How should they cooperate?**

All participants expressed a high willingness to cooperate and they are already contributing to a national and global discussion about digitalisation and asset management.

Technology can overcome many challenges apart from human error; especially misleading communication between the stakeholders in the digitalisation process is a major challenge. The cooperation should focus on formulating and understanding needs of different stakeholders; “translators” can help to facilitate cooperation between stakeholders. Further, clear data ontology needs to be created that enables a common understanding across Europe.

#### **What are benefits and challenges to cooperation?**

The key challenge for existing infrastructure is how to obtain reliable data and process the data. It was stated by all participants that there is shortage of skills to fully extract value from data. Many challenges in the digitalisation are not solved yet on national level where multiple BIM approaches can exist in one country.

#### **How can challenges be overcome?**

The MINnD ([www.minnd.fr](http://www.minnd.fr)) initiative was stated several times as an example of how cross sectoral cooperation for digitalisation in the infrastructure sector can be set up on a national level.

It was also suggested that end users / clients need to be better informed about the already existing digital solutions that can be procured today. Especially smaller cities were stated as a good environment to try out new approaches.

Communicating the key challenges that national transport infrastructure authorities are facing to their stakeholders is essential. The strategic Portuguese document which states the 50 innovations challenges which “Infraestruturas de Portugal” are currently facing was considered a suitable example for communication with stakeholders<sup>8</sup>.

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<sup>8</sup> <https://www.infraestruturasdeportugal.pt/pt-pt/inovacao/50-desafios-idi>



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## **i4Df – Regional Outreach Event East 15 Oct 2019, Warsaw/Poland**

### **Summary**

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## Summary

The i4Df Eastern Outreach event, the third of a series of four Regional Outreach events, was successfully held in Warsaw, Poland on the 15<sup>th</sup> of October 2019. The event was organized by the Polish Ministry of Infrastructure together with the Ministry of Maritime Economy and Inland Navigation. High level experts from Germany, Austria, Czech Republic, Slovakia, Hungary and Slovenia attended the full day event.

The event was chaired by Ms. Maria Perkuszezwska and commenced with a presentation of the Director of Transport Strategy Department, Mr. Adrian Mazur, both from the Polish Ministry of Infrastructure. Following, Mr. Peter Wilbers from Rijkswaterstaat (the Netherlands), coordinator of the i4Df initiative and Mr. Bernard Gyergyay from BAST (Germany), i4Df Task leader, gave their presentations on the i4Df initiative findings and developments.

Five thematic presentations, given by Ms. Maria Perkuszezwska, Mr. Michael Rohloff from BAST (Germany), Ms. Jana Pieriegud from Warsaw School of Economy (Poland), Mr. Pawel Krekora from the Ministry of Maritime Economy and Inland Navigation (Poland) and Mr. Piotr Durajczyk from Inland Navigation Administration Authority (Czech republic), offered the representatives of public administrations, national infrastructure administrations, universities and research institutes the opportunity to discuss the infrastructure capabilities, developments and potentials of the EU Eastern Countries.

Finally, three one-hour parallel sessions (in the form of “teaching aids” - colour cards) took place aiming to address the different needs in different parts of Eastern Europe regarding innovations in transport infrastructure and services.



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## **i4Df – Regional Outreach Event South 5 – 6 November 2019, Thessaloniki/Greece**

### **Workshop Report**

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## Introduction

The regional outreach event “South” was held in Charilaou – Themi, Thessaloniki, Greece, on 5<sup>th</sup> and 6<sup>th</sup> November 2019. The event started with presentations focussing on the aim of the infra4Dfuture project, the results achieved so far and the scope and aim of the regional outreach event. Further on, as an interactive part of the event, three workshops were organised in the morning of 6<sup>th</sup> November. This document reports on the outcome of the workshops.

Based on the infrastructure capabilities identified in the i4Df deliverable “D1.2 – Joint vision on transport infrastructure innovation until 2040” the following three break-out groups were set up with a moderator and rapporteur each:

### **Capability 1: Infrastructure optimally meeting end user needs**

Moderator: Ursula Blume (BASt, DE)

Rapporteur: Eleni Mavropoulou (CERTH/HIT, GR)

### **Capability 2: Infrastructure meeting environmental and social sustainability needs**

Moderator: Peter Wilbers (RWS, NL)

Rapporteur: Vassilis Kappatos (CERTH/HIT, GR)

### **Capability 3: Infrastructure achieving added value from digitalisation**

Moderator: Richard van der Elburg (RWS, NL)

Rapporteur: Anna Manukyan (CERTH/HIT, GR)

After a short introduction by representatives of the i4Df consortium, the groups were given 90 minutes to discuss the “hot” themes of each IFA, the benefits and challenges for cooperation as well as ideas on how to cooperate. Further on, the experts pointed out potential challenges and hindrances for a future cooperation.

After the break-out workshops were completed, the moderator presented the results from each group to the auditorium. In this report, the findings were grouped to the structure applied to the report of the Western and Northern outreach event to allow a structured evaluation of the results of all outreach events. The questions that were raised there are the following:

- What should IFAs cooperate on?
- How should they cooperate?
- What are benefits and challenges to cooperation?
- How can challenges be overcome?

## **Capability 1: Infrastructure optimally meeting end user needs**

Moderator: Ursula Blume (BAST, DE)

Rapporteur: Eleni Mavropoulou (CERTH/HIT, GR)

Participants:

- Prof. Angelous Mouratidis (AUPh, GR)
- Anghel Tanasescu (CNAIR, RO)
- Constantin Zbarnea (CNAIR, RO)
- Dr. Ilaria Coppa (ANAS, IT)
- Roberto Pieretti (ANAS, IT)

The discussion of the group focused on the three Innovation Focus Areas (IFAs) of this capability, especially on the existing and future needs for innovation in the thematic field of these IFAs.

Additionally to the discussion of the three IFAs, there was a feedback on the suggested i4Df cooperation mechanism: Although technical experts might be interested to join and are convinced by the benefits of a multi-modal cooperation, it was addressed that it might be difficult to reach for the decision makers to ask for their interest to join the initiative as this is a political decision and depends on the actual political situation and development. In general, the proposed cooperation mechanism was assessed to work well in practice.

### **How should IFA cooperate?**

The discussion started with a general discussion. There are big differences in the development of the infrastructure network of the different countries in Europe. Some countries still have to finalise their infrastructure network, i.e. to construct and build the missing links, whereas others have a comprehensive infrastructure that has to be maintained and upgraded according to new requirements. Also the financial capability of the single countries is decisive and needs to be considered – a higher budget will allow to not only focus on the technical needs of construction and maintenance but also to take into consideration additional research fields. This budget depends on the political situation and may change with a changing government.

It was addressed that the implementation of innovative project results should be tried to be realised on the TEN-T. This might help to speed up the implementation as well as to increase the perception of the innovation across borders. The question was raised which measures are necessary to be taken to achieve a real multi-modal research.

### **What are the benefits and challenges to cooperation?**

#### ***IFA 1.1: Network performance***

In most countries, the planning of the infrastructure network is based on traffic data and their predicted future development. This prognosis is the basis for the funding of the necessary maintenance. A cost-benefit-analysis is applied to prioritise the future projects. Often technical

facts about the assessment of the performance of the transport network are ranked secondary which might cause high expenditures for the future maintenance of the network. The experts suggested focusing more on the technical facts as they are decisive to achieve a sufficient and proper life-time and quality.

### ***IFA 1.2: Integrated infrastructure network management***

For the increase of the traffic flow and for safety reasons, the development of an on-board unit, especially for trucks, would be very helpful. Thus, it would be possible to record driving time and ways, speed, etc. and to then identify weak points, hindrances, congestions, etc. in the transport network. This information would be helpful to guide the traffic flow in the best way. The data could be further used for the identification of maintenance needs. It is necessary that countries would agree on the same technique to allow a consistent evaluation of data via this C2I-technique. IT mentioned the SLAIN project which focuses on the analysis of the safety of the road network. It might be of interest to share the project results achieved so far as well as to gain additional data.

### ***IFA 1.3: Responsible and innovative procurement and finance***

Procurement is not a technical requirement for transport networks. Nevertheless, it is considered as a separate IFA element of capability 1 because it is essential that procurement is taken into consideration at all stages of the lifetime of infrastructure – planning, construction, maintenance, and deconstruction.

Responsible procurement would be a procurement of products, assets, techniques and services which would be beneficial to the safety, trafficability and serviceability, ensuring uninterrupted operation of the network (no need for repetitive maintenance operations) and running infinitesimal risk to become shortly outdated.

It is important to mention the difference between financing (cost-benefit-analysis) and procurement. There was a remark on the fact that it is very difficult to decide on the proper distribution of the funding for the requirements of construction and the maintenance of transport infrastructure. In the end, this is a political decision.

### **How can challenges be overcome?**

At times of shortages and recession, any financing decision is important and critical. Innovative technologies to enhance network performance and operations must be screened through a CBA process, in terms of life-cycle of road assets. Moreover, social and environmental aspects, regarding the impact of these innovative technologies, should be also taken into consideration.

## **Capability 2: Infrastructure meeting environmental and social sustainability needs**

Moderator: Peter Wilbers (RWS, NL)

Rapporteur: Vassilis Kappatos (CERTH, GR)

Participants:

- Laura Peruzzi (ANAS, IT)
- Patrizia Bellucci (ANAS, IT)
- Zhjeqi Naser (Ministry of Infrastructure, Republic of Kosovo)
- Adi Gamliel (NETIVEI, IL)
- Fotini Kechagia (AUPh, GR)

In this session, the livability of the coordination mechanism was discussed. There is a big gap in how developed is the road network in different countries: in some countries the road network is bigger and more developed, while in some other countries there is a basic need of creating the basic road network and connect borders.

## **Capability 3: Infrastructure achieving added value from digitalisation**

Moderator: Richard van der Elburg (RWS, NL)

Rapporteur: Anna Manukyan (CERTH, GR)

Participants:

- Rolando Pizziconi (ANAS, IT)
- Neden Dimitriou Ilija (PE Roads of Serbia, RS)
- Hysen Merovci (Ministry of Infrastructure, Republic of Kosovo)
- Maria Tsami (CERTH, GR)

In the session of the third group, the following questions were discussed:

### **What should IFAs cooperate on?**

It was discussed how the data is considered to be the new oil, and it is important to know data target groups. The needs and the present situation and legislation were discussed.

### **What are the benefits and challenges to cooperation?**

It was mentioned that the communication between transport modes is very important, and for example in the case of Italy where 10 road service owners exist, each owner has information and data for the specific area it serves.

The exchange of information is possible; however there is a resistance from other operators because of business competition. Another issue mentioned is that there is no common structure to collect the information as well as guidance information is missing. A rather helpful implementation would be the multimodal apps that can give more incentives for the businesses. It is important to establish good procedures on how to collect data and how to use and share it.

The existence of disruptive players like Google was mentioned, as well as the AliBaba Chinese shopping application which already has resources to do traffic management. It was discussed that the information has many layers, while the end users need the upper level information.

### **How can challenges be overcome?**

The most important qualities of information are to be real, guaranteed and unique. As a bottom line, it was mentioned that the end users should be engaged in the processes of gathering information, and it is important to establish cooperative relations between all the users. The information should have quality, however to be able to source quality data time is needed. The data then should be standardized while the legal framework should exist to assist the processes and mediate the interaction of users.

## Annex C: Matching 11 selected programmes identified in the TRIMIS database with i4Df Innovation Focus Areas

Programme	IFA 1.1	IFA 1.2	IFA 1.3	IFA 2.1	IFA 2.2	IFA 2.3	IFA 3.1	IFA 3.2
CEDR Research Calls	X	X	X	X	X	X	X	X
FoPS Research Programm Urban Transport	X	X	X					
CoT - City of Things - smart cities and municipalities Flanders Innovation and Entrepreneurship (VLAIO)		X		X	X			X
TakeOff Federal Ministry for Transport, Innovation and Technology (BMVIT)			X	X	X	X	X	X
Shift2Rail	X	X	X	X	X	X	X	X
Future Mobility FFI - Strategic Vehicle Research and Innovation	X	X	X	X	X		X	X
Sustainable transportation	X	X	X			X	X	X
NordFoU	X	X	X	X	X	X	X	X
BRA - Baltic Road Association	X	X	X	X	X	X	X	X
D-A-CH	X	X	X	X	X	X	X	X

### **Programme: CEDR Research Call (CEDR: Conference of European Directors of Roads)**

<https://www.cedr.eu/17520/cedr-research-call-2019/>

- **Funding counties**

Funding open for all CEDR members, each topic of a Call is funded by at least three CEDR members.

- **Background and policy objectives**

CEDR Action Plan, regularly updated every three years (latest version: 2019-2021).

- **Affected transport mode(s)**



## Road

- **Frequency and duration**

Annual Call. Duration of the project: max. 3 years, implementation and assessment in the fourth years.

- **Underlying strategy**

CEDR Strategy (<https://www.cedr.eu/1106/td-strategy-2016-warsaw/>) .

- **Funding & budget**

Common pot model. Up to four topics with each up to three projects are funded. Budget: 2.5 to 5.9 Mio. €.

- **Matching infra4Dfuture Innovation Focus Areas:**

### 1.1 Innovation Focus Area: Network performance

Focus Area (FA) 3. Safety, Operations, Mobility and Performance

3.3 Traffic & network management

3.5 Performance of road network

3.6 Road user satisfaction / client orientation

### 1.2 Innovation Focus Area: Integrated infrastructure network management

Focus Area (FA) 3. Safety, Operations, Mobility and Performance

3.1 Road safety

3.2 Call 2016 Road safety

3.3 Traffic & network management

3.4 Winter service

3.5 Performance of road network

3.6 Road user satisfaction / client orientation

3.7 Call 2015 User needs in multimodal context

3.8 Call 2015 Freight and logistics in multimodal context

Focus Area (FA) 4. Resources and Asset Management

4.3 Asset management for transport infrastructures (AM4INFRA)

4.4 Call 2014 Asset Management and Maintenance

4.5 Call 2015 Asset information using BIM

4.6 Human resources / Professional development

4.7 Call 2017 Collaborative planning of infrastructure networks and spatial development

4.8 Ageing infrastructure

4.9 Project portfolio management and project management

1.3 Innovation Focus Area: Responsible and innovative procurement and finance

Focus Area (FA) 4. Resources and Asset Management

4.1 Procurement and finance

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

Focus Area (FA) 4. Resources and Asset Management

4.1 Procurement and finance

4.8 Ageing infrastructure

4.9 Project portfolio management and project management

2.2 Innovation Focus Area: Preserving the environment

Focus Area (FA) 2. Environment and resilience

2.1 Liaison with PIARC Technical Committee E1: Adaptation Strategies/Resilience

2.2 Call 2015 Climate change

2.4 Environment

2.5 Call 2016 Water quality

2.6 Call 2016 Biodiversity

2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

Focus Area (FA) 1. Digitalisation and innovation

1.1 Open data for NRAs

1.2 Connected & automated driving

1.3 Liaison with Amsterdam Group

1.4 Liaison DATEX II

1.5 Call 2014 Mobility & ITS

1.7 Innovation & Research

### 3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport

#### Focus Area (FA) 1. Digitalisation and innovation

- 1.1 Open data for NRAs
- 1.2 Connected & automated driving
- 1.3 Liaison with Amsterdam Group
- 1.4 Liaison DATEX II
- 1.5 Call 2014 Mobility & ITS
- 1.7 Innovation & Research

### 3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

#### Focus Area (FA) 1. Digitalisation and innovation

- 1.1 Open data for NRAs
- 1.4 Liaison DATEX II
- 1.7 Innovation & Research
- 1.8 Infravation
- 1.9 Call 2017 Automation
- 1.10 Call 2017 New materials and techniques

### ***Programme: Forschungsprogramm Stadtverkehr (FoPS) – Research Programme Urban Transport 2019/2020***

[http://mobilitaet21.de/wp-content/uploads/2019/08/Projektliste\\_FOPS\\_2019-2020.pdf](http://mobilitaet21.de/wp-content/uploads/2019/08/Projektliste_FOPS_2019-2020.pdf)

- **Funding country**  
Germany
- **Background and policy objectives**

The Research Programme Urban Transport (FoPS) is a funding programme of the Federal Ministry for Transport and Digital Infrastructures (BMVI) for improving transportation conditions in communities.

Objectives of FoPS are to elaborate and assemble application oriented, scientific and practical knowledge for decision makers in urban and regional transport.

Core of the programme is the application-driven investigation of specific questions, which shall ensure transferability to regions all over Germany. Basic research is accepted insofar it serves the application-based research. Planning tasks are considered research elements if they are designed as transferrable examples.

- **Affected transport modes**

Multimodal

- **Frequency and duration**

Annual Call since 1967

- **Underlying strategy**

Mobilität des 21. Jahrhunderts.

- **Funding & budget**

Federal Ministry for Transport and Digital Infrastructures BMVI. Public (national/regional/local). 4,167 Mio € annually.

- **Matching infra4Dfuture Innovation Focus Areas:**

- 1.1 Innovation Focus Area: Network performance
- 1.2 Innovation Focus Area: Integrated infrastructure network management
- 1.3 Innovation Focus Area: Responsible and innovative procurement and finance

***Programm: CoT - City of Things - smart cities and municipalities; Flanders Innovation and Entrepreneurship (VLAIO)***

<https://www.imeccityofthings.be/en/blog/smart-cities-in-vlaanderen-en-daarbuiten>

- **Funding country**

Belgium

- **Background and policy objectives**

In a smart city, governments, companies, research institutions and citizens create solutions for urban challenges. More and more physical objects are connected to the internet (Internet of Things). This allows for real-time collection of data and quicker monitoring of parameters. This programme supports cities and communities in the implementation of smart city applications using the Internet of Things to support economic growth or improve services to citizens. These applications can address transport and infrastructure topics, such as the reduction of congestion, sustainable inner-city distribution and optimisation of parking spaces.

- **Affected transport mode(s)**

Multimodal

- **Frequency and duration**

2017 – 2019

- **Underlying strategy**

Yes

- **Funding & budget**

Public (national/regional/local). Budget: 4 Mio €.

- **Matching infra4Dfuture Innovation Focus Areas:**

1.2 Innovation Focus Area: Integrated infrastructure network management

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

2.2 Innovation Focus Area: Preserving the environment

3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

***Programme: TakeOff - Federal Ministry for Transport, Innovation and Technology (BMVIT)***

- **Funding country**

Austria

- **Background and policy objectives**

In line with ACARE Flightpath 2050 goals, the new strategy promotes four measures to be deployed within the framework of a five-year action plan. These are:

- Build strategic partnerships;
- Strengthen Austria's competencies and skills in R&I;
- Foster visibility and market uptake;
- Facilitate excellent qualification.

- **Affected transport mode(s)**

Air

- **Frequency and duration**

2015 - 2020

- **Underlying strategy**

Yes

- **Funding & budget**

Federal Ministry for Transport, Innovation and Technology (BMVIT). Public (national/regional/local): Budget: 40 Mio €.

- **Matching infra4Dfuture Innovation Focus Areas:**

1.3 Innovation Focus Area: Responsible and innovative procurement and finance

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

2.2 Innovation Focus Area: Preserving the environment

2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport

3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

### ***Programme: Shift2Rail***

<https://shift2rail.org/>

- **Funding countries**

European Union

- **Background and policy objectives**

Shift2Rail (S2R) is the first European rail initiative to seek focused research and innovation (R&I) and market-driven solutions by accelerating the integration of new and advanced technologies into innovative rail product solutions. Shift2Rail promotes the competitiveness of the European rail industry and meets changing EU transport needs. R&I carried out under this Horizon 2020 initiative develops the necessary technology to complete the Single European Railway Area (SERA).

S2R seeks to develop, integrate, demonstrate, and validate innovative technologies and solutions that uphold the strictest safety standards and the value

- **Affected transport mode(s)**

Rail

- **Frequency and duration**

2014 – 2020

- **Underlying strategy**

Yes

- **Funding & budget**

EU Joint Undertaking (JU). Budget: 920 Mio €.

- **Matching infra4Dfuture Innovation Focus Areas:**

1.1 Innovation Focus Area: Network performance

1.2 Innovation Focus Area: Integrated infrastructure network management

1.3 Innovation Focus Area: Responsible and innovative procurement and finance

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

2.2 Innovation Focus Area: Preserving the environment

2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport

3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

***Programme: FFI - Strategic Vehicle Research and Innovation***

<https://www.vinnova.se/en/m/strategic-vehicle-research-and-innovation/>

- **Funder**

Sweden

- **Background and policy objectives**

FFI is a partnership between the Swedish government and automotive industry for joint funding of research, innovation and development concentrating on Climate & Environment and Safety. Initially set to run from 2009-2012 with no definite ending year.

Currently there are five collaboration programs:

- Energy and Environment
- Traffic Safety and Automated Vehicles
- Electronics, Software and Communication

- Sustainable Production
- Efficient and Connected Transport systems
- **Affected transport mode(s)**  
Road
- **Frequency and duration**  
2009 – 2015
- **Underlying strategy**  
Yes
- **Funding & budget**  
100 Mio. €/year, of which half is governmental funding.
- **Matching infra4Dfuture Innovation Focus Areas:**
  - 1.2 Innovation Focus Area: Integrated infrastructure network management
  - 2.1 Innovation Focus Area: Decarbonisation of infrastructure management
  - 2.2 Innovation Focus Area: Preserving the environment
  - 3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport
  - 3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

***Programme: Sustainable transportation***

- **Funder**  
Switzerland
- **Background and policy objectives**  
 Organisation made by Swiss Federal Roads Authority (ASTRA) together with the Federal Office of Transport (BAV) and the Federal Office for Civil Aviation (BAZL).  
 The programme focuses on:
  - sustainable development of traffic and reasonable use of individual means of transport;
  - planning and realisation of sustainable infrastructures for transportation;
  - improving global safety;



- promotion of intermodal use in the realm of passenger and goods traffic;
- improving the efficiency and optimal use of the capacities of all carriers.
- **Affected transport mode(s)**  
Multimodal
- **Frequency and duration**  
Starting in 2002, ongoing
- **Underlying strategy**  
Yes
- **Funding & budget**  
34.3 Mio. CHF for period 2017 to 2020
- **Matching infra4Dfuture Innovation Focus Areas:**
  - 1.1 Innovation Focus Area: Network performance
  - 1.2 Innovation Focus Area: Integrated infrastructure network management
  - 1.3 Innovation Focus Area: Responsible and innovative procurement and finance
  - 2.3 Innovation Focus Area: Integrating multi-layer networks and nodes
  - 3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport
  - 3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

**Programme: Future Mobility**

[https://www.bmvit.gv.at/en/topics/innovation/mobility/future\\_mobility.html](https://www.bmvit.gv.at/en/topics/innovation/mobility/future_mobility.html)

- **Funding country**  
Austria
- **Background and policy objectives**  
The research programme is developing designs to setup the mobility system of the future, a system to balance social, environmental and economic needs. The programme helps to develop systems that contribute significantly to ensuring mobility while minimising the negative impacts of transport. The complex interactions inherent in transport systems require interdisciplinary research approaches aiming at developing both technological and social organisational innovations. Thus, the

programme focuses on new markets, generating solutions that respond closely to the essential needs of society.

- **Affected transport mode(s)**

Road

- **Frequency and duration**

2012 - 2020

- **Underlying strategy**

Yes

- **Funding & budget**

Budget: Annual Budget: 13 - 19 Mio. €. Coverage: Austria (primarily), international participation possible

- **Matching infra4Dfuture Innovation Focus Areas:**

1.1 Innovation Focus Area: Network performance

1.2 Innovation Focus Area: Integrated infrastructure network management

1.3 Innovation Focus Area: Responsible and innovative procurement and finance

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

2.2 Innovation Focus Area: Preserving the environment

2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport

3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

**Programme: NordFoU**

<http://www.nordfou.org/Sider/fqj.aspx>

- **Funding countries**

Denmark, Finland, Faroe Island, Iceland, Norway, Sweden

- **Background and policy objectives**

NordFoU is a co-operation between the national Nordic road administrations to initialize, finance and run R&D projects. Its aim is to run and develop R&D with

respect to innovation, synergy and development of Nordic R&D environments for the benefit of the Nordic road and traffic systems.

- **Coordination mechanism**

Base organisation:

Members of all NordFoU activities are officially nominated members of road/transport authorities. There is a base organisation consisting of a Steering Committee, a Task Force and a Secretariat.

The base organisation is responsible for strategic planning, project proposals, follow-up on ongoing projects and coordination of other joint Nordic R&D activities. Further on, it is responsible for setting up and handling management control, financing and financial reporting for projects within the auspices of NordFoU.

The chair rotates between the Nordic road and transport administrations every year.

- **Affected transport mode(s)**

Road

- **Frequency and duration**

Annual calls for specific topics

- **Underlying strategy**

No

Current research topics include: Winter maintenance, Road infrastructure, Climate change solutions for roads and road transport, Environmental research, Road technology research.

- **Funding & budget**

NordFoU is not a fund. Projects are financed by national road/transport authorities. In the majority of the cases, the "common pot system" is applied: The financial partners establish a project fund. The scientific partners get reimbursed from this fund. Any unused funds are reverted back to the original donor.

- **Matching infra4Dfuture Innovation Focus Areas:**

1.1 Innovation Focus Area: Network performance

Road Markings Management System (RMMS)

State assessment of road markings in the Nordic countries (ROMA)

Winter maintenance (EPAS 2)

1.2 Innovation Focus Area: Integrated infrastructure network management

Road state monitoring system (ROSTMOS)

Update on new solutions that can supplement existing systems or replace traditional technology (NorSIKT)

Life Cycle Analyses Tools to Assess Climate Impact of Road Building (NordLCA)

External influences spray patterns - particular focus on salt quality, vehicle speed and drive system (EPAS)

Road Works During Night

Pavement Performance Models: Development of the condition of the road pavement in relation to traffic and climate. Validation of Performance Models (PPM2)

Bridges without waterproofing

Evacuation of Roadtunnels/Safety in Tunnels/Emergency lights in tunnels

Life Cycle Analyses for Bridge Management (ETSI III)

Mobile Measurement

1.3 Innovation Focus Area: Responsible and innovative procurement and finance

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

Heating Road with Stored Solar Energy (HERO)

2.2 Innovation Focus Area: Preserving the environment

Road dust emission, modelling and mitigation in Nordic conditions (NorDust)

Reducing highway runoff pollution (REHIRUP)

Durability of pavements that reduces noise and rolling resistance (DURAPAV)

Noise calculation model (Nord 2000)

Tyrelabeling and Nordic traffic noise (Nordtyre 1, 2, 3)

Principles for the design of road surfaces where noise levels should be limited (NordTex)

2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport

3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

Modelling Residual Salt (MORS)

<http://www.balticroads.org/>

- **Funding countries**

Estonia, Lithuania, Latvia

- **Background and policy objectives**

The Baltic Road Association (BRA) was established in 2014 as a non-profit organisation in Estonia. It continues cooperation of the Estonian, Latvian and Lithuanian Road Administrations.

Key aim of the BRA is to seek possibilities for mutual co-operation, such as:

- To conduct joint studies;
- To co-ordinate the work of technical expert groups;
- To organize seminars of mutual interest;
- To organize international road conference every four years;
- To participate, if needed, in the process of harmonization of the legislation in the EU road sector;
- To co-operate with other relevant international organizations;

The presidency of BRA is based on a four-year rotation principle. The cycle is summed up in the international conference and exhibition. There are Technical Committees on the following five topics: Construction, Traffic Safety, Maintenance, Research, ITS.

In each of the five Technical Committees there are each two experts from the three member states. They meet biannually. An Action Plans describes the scope of the work of each Technical Committee.

- **Affected transport mode(s)**

Road

- **Frequency and duration**

./.

- **Underlying strategy**

No

- **Funding & budget**

BRA itself is not a fund and there is no fixed budget for common research projects. If agreed on, joint studies are financed by the three national road authorities.

- **Matching infra4Dfuture Innovation Focus Areas:**

- 1.1 Innovation Focus Area: Network performance
- 1.2 Innovation Focus Area: Integrated infrastructure network management
- 1.3 Innovation Focus Area: Responsible and innovative procurement and finance
- 2.1 Innovation Focus Area: Decarbonisation of infrastructure management
- 2.2 Innovation Focus Area: Preserving the environment
- 2.3 Innovation Focus Area: Integrating multi-layer networks and nodes
- 3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport
- 3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

**Programme: D-A-CH**

- **Funding countries**

Austria, Switzerland, Germany

- **Background and policy objectives**

The three German-speaking countries launch annual in the field of transport infrastructure Calls since 2016. The research topics result from comparable or even similar research questions. Therefore the financial resources are bundled to fund common projects allowing a more effective research. Good practices are applied for the annual calls resulting in an effective administration and the avoidance of double research.

Each partner willing to support the annual call signs a cooperation agreement and thus agrees to fund the call by a certain budget. Experts from the road administrations supervise the selection of the consortia and the projects during the runtime of the projects.

- **Affected transport mode(s)**

Road

- **Frequency and duration**

Annual calls for specific topics

- **Underlying strategy**

No. The topics arise from the regular meetings on special topics attended by experts from AT, CH and DE. Every year, up to 4 topics are identified for common research

calls. Some of the first calls tackled a certain field of transport infrastructure, e.g. concrete or asphalt roads.

- **Funding & budget**

Basis for the research is a Real Common Pot. The Budget is agreed on for each individual project of the topic by the funding partners. This results in the overall budget of each of the annual Calls.

- **Matching infra4Dfuture Innovation Focus Areas:**

1.1 Innovation Focus Area: Network performance

1.2 Innovation Focus Area: Integrated infrastructure network management

*D-A-CH Call 2016 "Development of the concrete technology for the application in road construction":*

Grinding & Grooving of concrete pavements

Quick repair with prefabricated concrete panels

Mechanical characteristic values for concrete

Avoidance of Alkali-Silica-Reaction

*D-A-CH Call 2017 "Asphalt Technology":*

Ageing of asphalt mixes

Performance of asphalt

Coars aggregates for asphalt mixes

*D-A-CH Call 2018 "Pavement management":*

Prognosis of the development of the performance

Automated detection

*D-A-CH Call 2019: Energy/Digitalisation/Road construction:*

Grinding of textures for concrete pavements

1.3 Innovation Focus Area: Responsible and innovative procurement and finance

*D-A-CH Call 2018 "Pavement management":*

Technical asset value

2.1 Innovation Focus Area: Decarbonisation of infrastructure management

*D-A-CH Call 2019: Energy/Digitalisation/Road construction:*

Covering of a road with photovoltaic modules

BIM - Building Information Modelling for road construction

Grinding of textures for concrete pavements

2.2 Innovation Focus Area: Preserving the environment

D-A-CH Call 2017 "Asphalt Technology":

Durability of noise-reducing asphalt pavements

D-A-CH Call 2019: Energy/Digitalisation/Road construction:

Covering of a road with photovoltaic modules

2.3 Innovation Focus Area: Integrating multi-layer networks and nodes

3.1 Innovation Focus Area: Smart data and information ecosystem for accommodating automated and connected transport

3.2 Innovation Focus Area: Information provision for process optimisation in infrastructure management

D-A-CH Call 2019: Energy/Digitalisation/Road construction:

BIM - Building Information Modelling for road construction



## Annex D: Matching Horizon Europe with i4Df Innovation Focus Areas

CLUSTER 4 - DIGITAL, INDUSTRY AND SPACE	IFA 1.1 IFA 1.2 IFA 1.3			IFA 2.1 IFA 2.2 IFA 2.3			IFA 3.1 IFA 3.2	
I. Enabling technologies ensuring European leadership and autonomy								
4.1 Manufacturing Technologies								X
4.2 Key Digital Technologies							X	X
4.3 Advanced Materials					0			
4.4 Emerging Enabling Technologies								X
4.5 Artificial Intelligence and Robotics							X	X
4.6 Next Generation Internet								X
4.7 Advanced Computing and Big Data								X
4.8 A globally competitive space sector reinforcing EU autonomy							0	0
II. Accelerating economic and societal transitions								
4.9 Circular Industries				X				X
4.10 Low-carbon and Clean Industries				X				
a. New services from Space for the EU society and economy							X	X

X – strong link, 0 – link (less strong as for 'X')

CLUSTER 5 - CLIMATE, ENERGY AND MOBILITY								
	IFA 1.1	IFA 1.2	IFA 1.3	IFA 2.1	IFA 2.2	IFA 2.3	IFA 3.1	IFA 3.2
4.1 Advance climate science and solutions for a climate neutral and resilient society				X				
4.2 Cross-sectoral solutions for decarbonisation				X				
4.2.1 Establish a competitive and sustainable European battery value chain				0				
4.2.2 Strengthen the European value chain for low-carbon hydrogen and fuel cells				0				
4.2.3 Develop sustainable infrastructure, services and systems for smart and sustainable communities and cities				0		X		
4.2.4 Foster emerging breakthrough technologies and climate solutions				0				
4.3 Develop cost-efficient, net zero-greenhouse gas energy system centred on renewables				0				
4.3.1 Achieve global leadership in renewable energy				X				
4.3.2 Develop flexible, zero greenhouse gas emission and citizen-centred energy systems and grids								
4.3.3 Develop carbon capture, utilisation and storage (CCUS) solutions for the power sector and energy-intensive industries				X				
4.3.4 Develop flexible and efficient energy storage solutions				0				
4.3.5 Leverage more public and private investments in clean energy systems				X				
4.4 Develop demand side solutions to decarbonise the energy system								
4.4.1 Empowering citizens to engage in energy markets								
4.4.2 Achieving a highly energy-efficient and decarbonised EU building stock				0				
4.4.3 Support industrial facilities in the energy transition								

4.5 Develop low-carbon and competitive transport solutions across all modes								
4.5.1 Achieve zero-emission road transport					X			
4.5.2 Enhance the competitiveness of rail as a low-carbon mode of transport					X			
4.5.3 Make aviation cleaner and more competitive								
4.5.4 Enable low-carbon, smart, clean and competitive waterborne transport					X			
4.5.5 Reduce the impact of transport on the environment and human health					X	X		
4.6 Develop seamless, smart, safe, accessible and inclusive mobility systems								
4.6.1 Make automated and connected road transport safe and competitive								X
4.6.2 Develop efficient and innovative transport infrastructure	X	X	X		X	X	X	X X
4.6.3 Develop the future transport network and integrated traffic management								X X
4.6.4 Enable multimodal freight logistics and passenger mobility services								X X
4.6.5 Increase transport safety across all modes	X	X						

X – strong link, 0 – link (less strong as for 'X')