European Commission

SCIENCE FOR POLICY BRIEFS

Assessing new and emerging transport technologies: Identifying opportunities for innovation

Headlines

- This study identifies 797 technologies falling within 45 technology themes from 2242 transport related European Framework Programmes from the Transport Research and Innovation Monitoring and Information System (TRIMIS) database.
- The technologies have been assessed for their innovation potential on the basis of relevant criteria (total investment, number of projects that have researched the technology, number of organisations involved, technology development phase, etc.).
- A full report forthcoming in the second half of this year will provide the complete assessment together with detailed policy recommendations.

Introduction

In 2017, the European Commission's Strategic Transport Research and Innovation Agenda (STRIA) identified priority areas with specific actions for future R&I, outlined in seven roadmaps:

1. Cooperative, connected and automated transport
2. Transport electrification
3. Vehicle design and manufacturing
4. Low-emission alternative energy for transport
5. Network and traffic management systems
6. Smart mobility and services
7. Infrastructure

The Transport Research and Innovation Monitoring and Information System (TRIMIS) supports STRIA by monitoring the status of transport research across Europe. One of the sub-tasks of TRIMIS is the creation of an inventory and regular reporting on new and emerging technologies and trends (NETT) in the transport sector. The goal is to assist policymakers and researchers in identifying opportunities for innovation in transport, so that additional supportive measures can be taken. The approach links to the work done by the Innovation radar, but adopts a transport technology specific focus. This policy brief showcases the initial results of this process.

Methodology

The TRIMIS NETTs analysis currently focusses on technologies researched in European Framework Programmes (FP), specifically FP7 and Horizon 2020 (H2020) projects. A total of 2242 projects fall within the scope. Within these projects, a total of 797 technologies was identified, also showing that many European funded projects do not focus solely on technology development.

An iterative approach led to the development of a consistent taxonomy for transport technologies and technology themes. In a subsequent step a set of metrics was established to assess the technologies. These metrics are intended to indicate the potential for the technology to be taken forward to application through the level of support for its development.

The metrics analysed in this task were:

- The number of projects that have researched the technology;
- The total value of all projects that have researched the technology (i.e. the total investment, by both the EU and industry, in the development of the technology);
- The number of organisations that have been involved in projects that have researched the technology;
- The total number of projects that the organisations (identified as having been involved in projects researching the particular technology) have been involved in.

The first two metrics highlight the combined effort that has been put into the technology, while the third and fourth proxy the level of interest in the technology in industry and academia, indicating the available capabilities to bring the technology to market.

In addition, technology maturity was assessed. Four technology development phases were defined that broadly relate to the following technology readiness levels (TRL):

a. phase 1 – Fundamental research (TRL 1-3)
b. phase 2 – Validation (TRL 4-5)
c. phase 3 – Demonstration (TRL 6-7)
d. phase 4 – Implementation (TRL 8-9)

A development phase was assigned to each project-technology combination, by scanning the project for explicit references or based on expert judgement.

Results

An overall 'top 20' technologies was identified for each roadmap, with the aim of including a balanced number of technologies for the different transport modes.

Table 1 provides an overview of the top 3 technologies for the seven STRIA roadmaps. When the same technology was identified under multiple transport modes it was included only

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once. In cases where the technology relates to multiple modes, it was assigned to the 'multimodal transport' mode; in other cases, where the technology is clearly primarily relevant to a specific transport mode, it was assigned to that mode.

Table 1: Top 3 technologies for the seven STRIA roadmaps

Principal Roadmap	Technology	Primary Transport Mode	Number of projects	Number of organisations	Value of projects per technology (million EUR)
ALT	Alternative aviation fuels	Air	6	25	€51
	Heavy duty engine design for alternative fuels	Road	3	17	€46
	Biofuels for road transport	Road	7	37	€35
CAT	Cockpit-based technologies for improved pilot workflow	Air	14	50	€146
	Technologies to improve road safety	Road	26	78	€97
	ADAS learning and harm prevention platforms	Road	15	55	€73
EV	Hydrogen refuelling station using ionic compressor	Road	10	38	€201
	Hydrogen production using an electrolyser system	Waterborne	9	38	€198
	Efficient and compact hybrid powertrains	Road	5	26	€49
INF	Decision Support Tools for infrastructure management	Multimodal	5	22	€51
	Railway operations and management	Rail	15	37	€43
	Field testing of the road infrastructure management systems	Road	8	32	€37
NTM	Collaborative logistics ecosystem	Multimodal	41	157	€144
	Air traffic management systems	Air	12	38	€134
	Multimodal border management technologies	Multimodal	64	150	€124
SMO	Sustainable urban mobility planning	Multimodal	93	348	€326
	Evidence-based research for road safety	Road	11	55	€62
	Eco-Drive app	Road	9	43	€60
VDM	Highly efficient aircraft engine	Air	14	39	€161
	Composite materials for structural purposes in the aircraft	Air	22	64	€106
	Hybrid wing blended body	Air	3	16	€85

Abbreviations - ALT: Low-emission alternative energy for transport; CAT: Cooperative, connected and automated transport; EV: Transport electrification; INF: Infrastructure; NTM: Network and traffic management systems; SMO: Smart mobility and services; VDM: Vehicle design and manufacturing

As indicated, a number of overarching technology themes were defined. The themes show how technologies cluster together and which fields of research receive relatively greater interest. A long list of themes was created and consequently reduced to the minimum number of themes under which all technologies could still be logically placed. This process led to a total of 45 themes. The creation of the technology and technology theme taxonomy, enables different visual representations. The tree structure of figure 1 highlights the key metrics of the top 25 technology themes in terms of total budget. The metrics shown (starting from the inner part of the circular section) are:

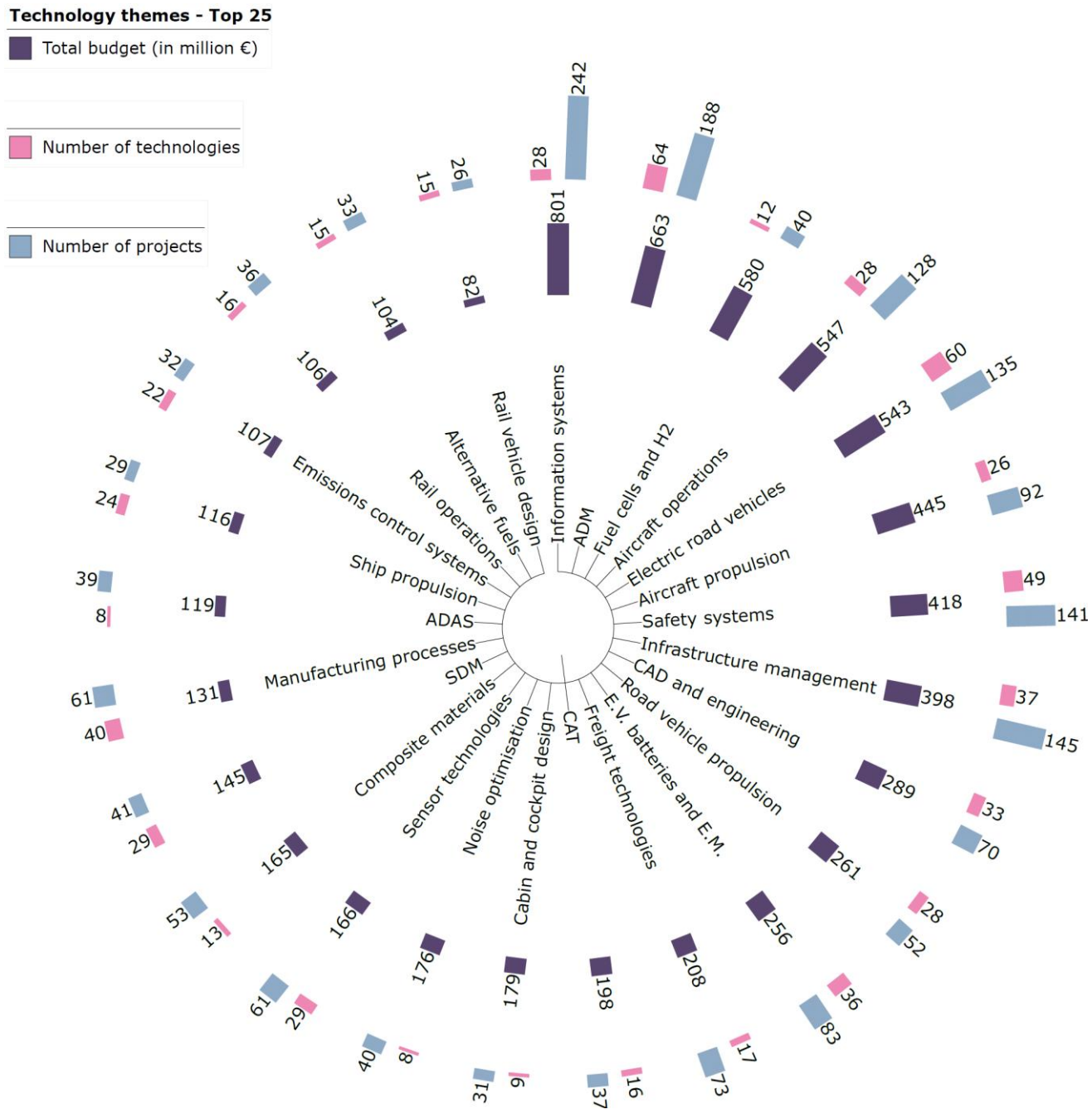

Figure 1: Top 25 technology themes

Abbreviations - ADM: Aircraft design and manufacturing; CAD: Computer-aided design; E.V.: Electric vehicle; E.M.: Energy management; CAT: Connected and automated vehicles; SDM: Ship design and manufacturing; ADAS: Advanced driver assistance systems

- "Total budget" (bars in violet)
- "Number of technologies" (bars in pink)
- "Number of projects" (bars in light blue)

Beyond the top technologies, we also identify the geographical spread of 1.6 billion euro of funding across 332 NUTS2 regions by research phase. For each region, the relative share of research funding is determined. Some regions have all research funds, hence 100%, allocated to one research phase. Others show a more balanced portfolio, with funds being equally spread between fundamental, validation and demonstration research. The total shares of the four phases add up to 100 percent. When observing the results across the board it's noticeable that most funds are clearly assigned to fundamental research. The design of the FPs explains that to a large degree. There are nevertheless regional differences visible.

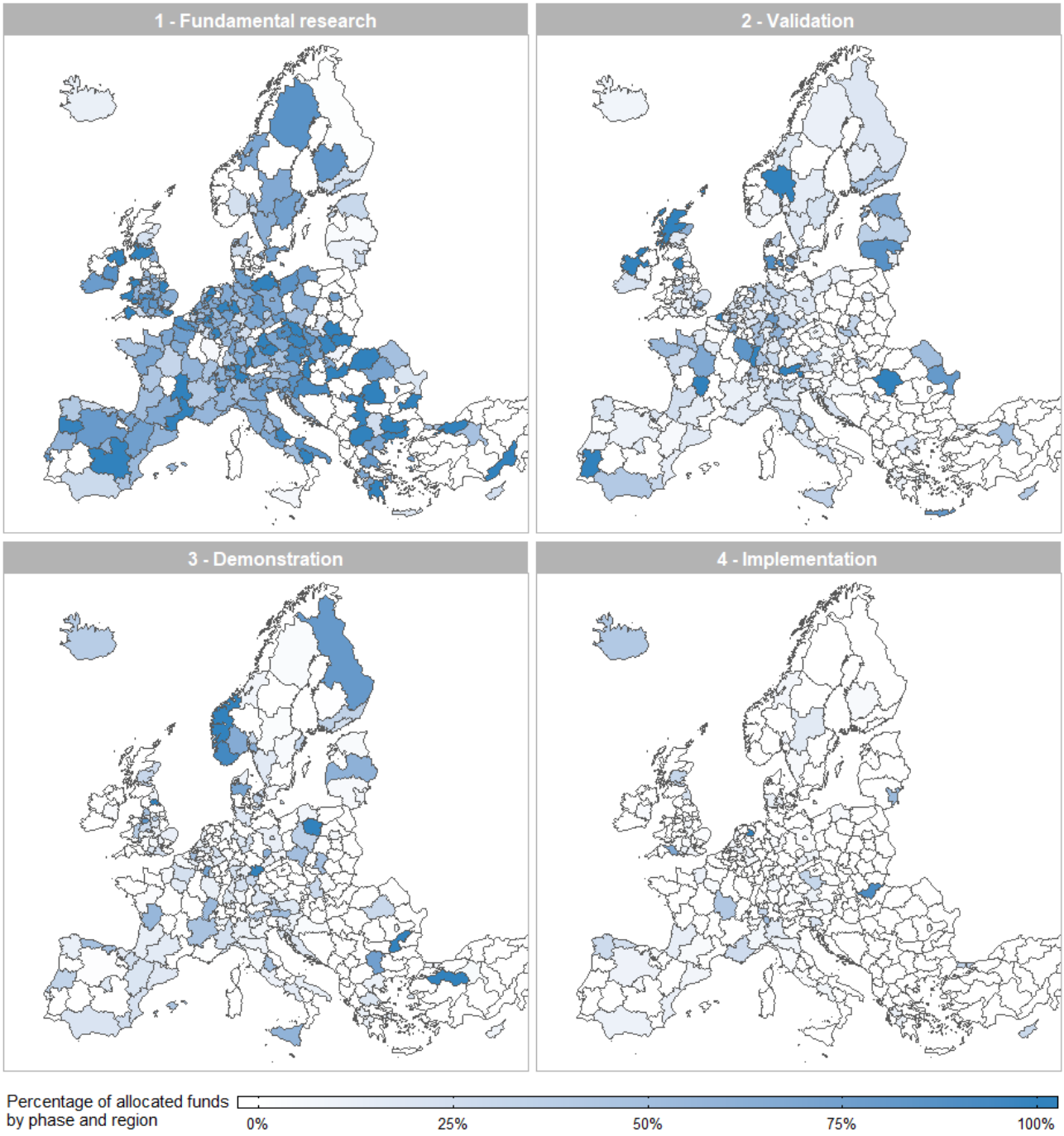

Figure 2: Regional share of transport research by research phase (FP7 and H2020)

Conclusions

This brief provided a first look on the technology assessment as performed by TRIMIS. By linking technology metrics with organisational data, technology value chains can be identified and assessed. This information can contribute to the optimisation of funding programmes and the development of targeted measures to promote transport innovation. In a future report, these analyses are provided in greater detail.

Disclaimer: The views expressed here are purely those of the JRC TRIMIS team and may not, under any circumstances, be regarded as an official position of the European Commission. Gareth Horton at Ricardo plc is acknowledged for his comments and contributions.

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