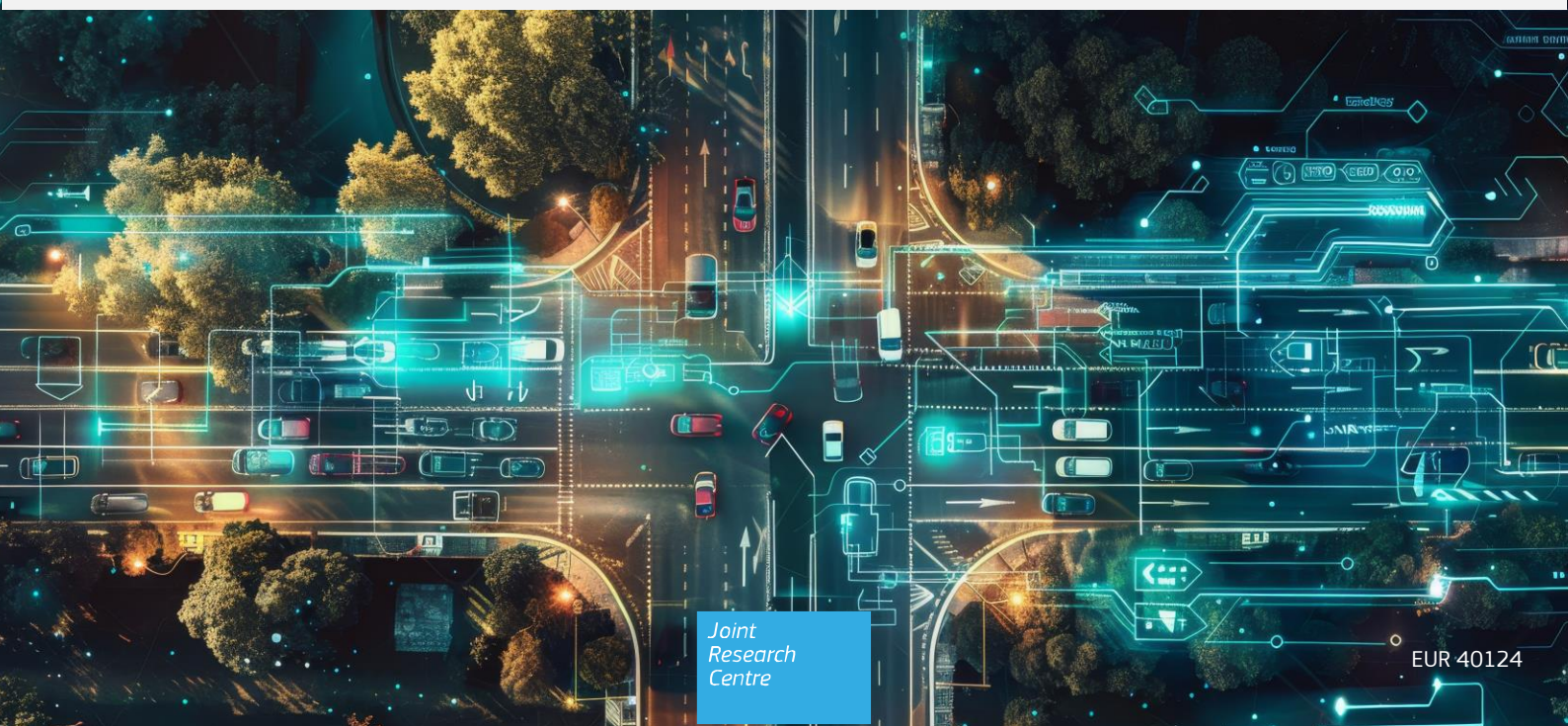European Commission

# EU Transport Research & Innovation Status Assessment Report 2022

*An overview based on the Transport Research and  Innovation Monitoring and Information System (TRIMIS)*

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# Contents

1

# Abstract

The Transport Research and Innovation Monitoring and Information System (TRIMIS) is an open-access transport information system and policy support tool. This report provides an overview of the status of the TRIMIS database at the end of 2022, which marks the conclusion of the Horizon 2020 Framework Programme. The TRIMIS database has grown significantly since the previous report, now containing over 8,300 research and innovation projects, a 10% increase from its previous state. The database provides a comprehensive picture of transport research and innovation in Europe, including information on the type of funding, share of EU contribution, and structure of projects based on transport modes, thematic areas, and technologies investigated. The report also presents an analysis of the database's content, highlighting trends and areas of focus in transport research and innovation. Additionally, it showcases the TRIMIS team's Science for Policy analyses, which provide evidence-based insights to support EU transport policies and decision-making processes.

## Acknowledgements

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# Executive summary

The Transport Research and Innovation Monitoring and Information System (TRIMIS) is the European Commission's analytical tool for mapping transport technology trends and research and innovation (R&I) capacities in Europe. Launched in September 2017 by the European Commission in its Joint Research Centre, TRIMIS has been funded under the Horizon 2020 Work Programme 2016-2017 on Smart, Green and Integrated transport and continues under the Horizon Europe Framework Programme.

The report provides an overview of the TRIMIS database at the end of the Horizon 2020 Framework Programme (up to December 2022). It highlights developments since the previous report (database snapshot up to November 2020). The report showcases main database developments and presents an overall assessment of transport R&I in Europe. Additionally, it summarises TRIMIS team's publication activities, including Science for Policy reports and briefs, as well as scientific publications. Finally, the report outlines future plans and developments.

## *Policy context*

Following the goals of the European Green Deal, the Sustainable and Smart Mobility Strategy, and the new Urban Mobility Framework, the European Commission's transport and research and innovation policies aim to promote sustainable, smart, and safe mobility. To achieve these ambitions, it is essential to stay at the forefront of innovation and technological advancements.

As an open-access information and knowledge management tool, TRIMIS plays a crucial role in supporting these efforts. It provides a comprehensive overview of transport research and innovation activities in the European Union and beyond. TRIMIS helps track progress towards defined targets by analysing technology trends and assessing the research and innovation capacities of the European transport sector. By doing so, TRIMIS provides valuable feedback to policy makers, enabling them to make informed decisions.

## *Key conclusions*

The TRIMIS database has undergone significant developments and improvements, building on previous efforts and recommendations. The key conclusions include:

— At the end of 2022 the TRIMIS database had grown to over 8,300 research and innovation projects, with a 10% increase since the previous Status Assessment report (end of 2020);

— Data quality improvements have been made, including removal of duplicates and updates of project details;

— Research and innovation Framework Programmes remain the main source of projects, with 55% of projects funded from FP7 and Horizon 2020;

— Road transport dominates the database, with *Vehicle design and manufacturing* being the thematic area with the highest increase of projects;

— Further extension and quality improvement of the database are still needed to achieve its full potential;

— Continued research activities are necessary to support the development of a comprehensive transport research and innovation agenda.

### Main findings

The TRIMIS database has undergone significant updates and improvements, resulting in a more comprehensive and accurate representation of transport research and innovation activities in Europe. The main findings from the latest database assessment are:

— The TRIMIS database added 990 new projects and removed 235 due to cleaning procedures, resulting in a net increase of 755 projects;

— Almost two-thirds of all projects in the database are funded by European programmes, mostly by subsequent research and innovation Framework Programmes;

— The funding structure of projects in the database remained relatively stable during the reporting period;

— Most European projects received EU funding between EUR 1 and 10 million, with a range of EUR 50 000 to over EUR 100 million;

— Road transport projects dominate the database, accounting for over a third of all projects, followed by airborne transport (26.2%); rail and waterborne transport receive less attention;

— Over 22% of projects cover more than one transport mode within their scope;

— The TRIMIS database contains over 900 technologies, grouped into 48 aggregated technology themes, with the most diverse technologies found in the road transport sector.

— The most investigated transversal technology themes, with potential applications across multiple transport modes, are *Infrastructure management* and *Safety systems*.

### Related and future JRC work

The TRIMIS database will continue to expand, with a focus on incorporating projects already awarded from the current Horizon Europe Framework Programme. In the next period, efforts will also be made to include more projects supported from EU funds within programmes other than research and innovation framework programmes. To further enhance the database's accuracy and relevance, the TRIMIS team is planning a review and update of the technology taxonomy. Additionally, a review and quality improvement of transport-related tags will be conducted, including replenishment of missing tags to ensure completeness and consistency. Building on this enhanced database, the TRIMIS team will continue to prepare Science for Policy reports and briefs, providing timely and evidence-based insights to support EU transport policies and decision-making processes.

### Quick guide

Following the introduction, the section 2 provides an in-depth overview of the TRIMIS database, highlighting the changes that were implemented since the previous Status Assessment report. Section 3 focuses on the Science for Policy analyses, which were conducted using the TRIMIS database as a primary source. The final chapter summarises the key findings and outlines the future direction of the project.

# 1    Introduction

TRIMIS is the Transport Research and Innovation Monitoring and Information System. It was launched in September 2017 and it is developed by the European Commission's Joint Research Centre. TRIMIS was funded under the Horizon 2020 Work Programme 2016-2017 on Smart, Green and Integrated transport and it continues during the Horizon Europe Framework Programme. TRIMIS is designed as an open-access information and knowledge management tool that provides a comprehensive overview of transport research and innovation activities. It collects information about research and innovation activities in transport in European Union and beyond. Moreover, TRIMIS provides feedback to policy by tracking progress towards defined research targets. Finally, it analyses technology trends and research and innovation capacities of the European transport sector.

One of the main components of TRIMIS is its original and open database of transport research and innovation projects. At the end of 2022 it contained over 8,300 records including projects funded from European research and innovation Framework Programmes (e.g. Horizon 2020, 7th Framework Programme – FP7), other European Framework Programmes (e.g. Interreg, Connecting Europe Facilities), as well as projects funded by some Member States and other countries. The TRIMIS Search Hub ([1]) provides an open access to the database, allowing a user to filter results using keywords as well as predefined filters. The Search Hub also allows a user to download the full database.

This report is the fourth overview of the database and research-oriented TRIMIS activities. The main aim of this edition of the report is to present some key policy-relevant transport research and innovation findings through the analysis of the TRIMIS database at the end of the Horizon 2020 Framework Programme. By presenting developments of the database made since the last Status Assessment report (Marques dos Santos et al., 2021) it is possible to show the connection between, on the one hand, the funding sources and, on the other hand, the transport mode, transport sector and STRIA roadmaps. Furthermore, the analysis of the database developments provides insight into the transport technology evolution at research and innovation level, which is essential to verify the link between the EU policy strategies and their implementation. This report presents, moreover, the key research areas and topics that have been investigated in the concerned period, giving indications on important transport policy issues that deserved ad hoc investigation in order to provide focused and up to date scientific evidence supporting the development of policy measures. The previous Status Assessment report presented the snapshot of the database made on 26 November 2020, while the current one shows the status of the TRIMIS database on 31 of December 2022. Thus, the report concentrates on the analysis of the changes in the database in the years 2021-2022. During this period, a major revamp of the TRIMIS portal ([2]) took place, which included also modifications of the structure of the database (see section 2.1 for details). Apart from the status of the database and its changes, the report contains an overview of the TRIMIS research activities and publications.

The structure of the report reflects the main aims of the publication described above. Section 2 describes the TRIMIS database and major changes of its content in the years 2021-2022. Chapter 3 presents Science for Policy analyses conducted with an extensive use of the TRIMIS database. It also offers an overview of other research activities conducted by the TRIMIS team. The final chapter concludes and outlines future work.

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[1] https://trimis.ec.europa.eu/search

[2] https://trimis.ec.europa.eu/

## 2 TRIMIS database

### 2.1 Presentation of the TRIMIS database

The role of TRIMIS project is to collect, curate, analyse and disseminate data on transport research and innovation in Europe and beyond and to analyse technology trends and research and innovation capacities in transport sector. It's main tool to realize this aim is an open, curated database of transport research and innovation projects. TRIMIS contributes to transport research and innovation by collecting data on research and innovation activities. It then uses this data to provide tailored analyses, offering feedback on main trends, achievements, and identified research gaps in specific areas. For example, research and innovation in public transport, urban mobility, or car sharing are recent examples.

All those analyses make an extensive use of the TRIMIS database of transport research and innovation projects. The TRIMIS database is regularly verified and improved and expanded with new projects. The database includes over 8 300 transport related research and innovation projects funded by European Commission (e.g. through FP7 and H2020 framework programmes as well as other European programmes) and by Member States (Figure 1). The open and searchable online version of the database is available via TRIMIS portal ($^3$) and it provides a comprehensive overview on funding and organisations involved in research and innovation in the transport sector.

**Figure 1.** Composition of the TRIMIS database

**Composition of the TRIMIS database**

The TRIMIS project collects and disseminate data from scattered and sometimes hardly available sources.

**8 337**: all projects in the database

**4 575**: projects funded within Framework Programmes

**Framework Programmes** of the European Union: the largest research and innovation programme in the world.

**2 001**: projects funded within Horizon 2020 Framework Programme (2014-2020)

*Source: TRIMIS*

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³ https://trimis.ec.europa.eu/search
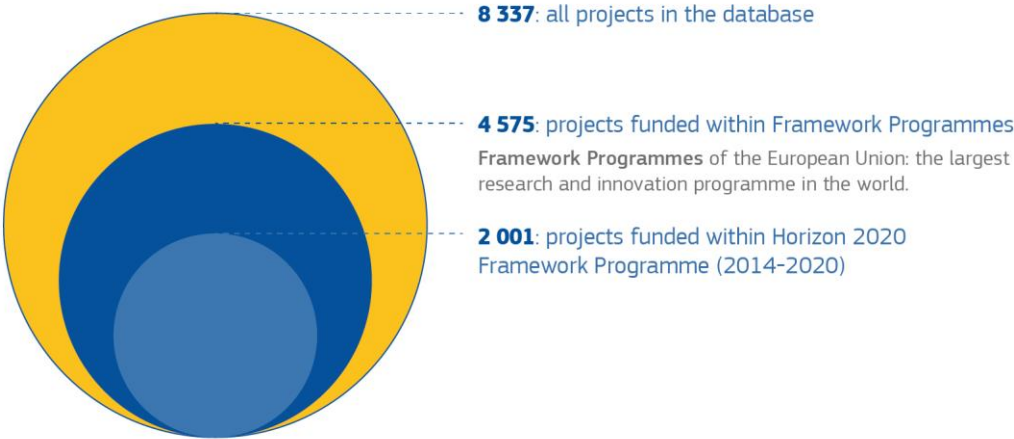
The structure of the database was modified together with the revamp of the TRIMIS portal (spring 2021). Some variable names had been changed during the process (consult Table 1 for the current list of variable names, their description, data sources and availability). Additionally, instead of separate variables for each of the seven STRIA roadmaps, the coverage of the thematic area is now included in one single variable (STRIA Roadmap).

**Table 1.** TRIMIS database structure

| Field | Description | Source [4] | Availability [7] |
|---|---|---|---|
| VID | Internal ID number | TRIMIS | Internal |
| NID | Internal ID number | TRIMIS | Internal |
| Cordis RCN | CORDIS record number of project description | CORDIS / - [5] | Internal |
| Cordis ID | CORDIS project ID number | CORDIS / - [5] | Public |
| Title | Full title of the project | CORDIS / TRIMIS | Public |
| Acronym | Acronym of the project | CORDIS / TRIMIS | Public |
| Original Language Title | Full project title if the original title is in different than English | TRIMIS | Public |
| Start date | Start date of the project | CORDIS / TRIMIS | Public |
| End date | End date of the project | CORDIS / TRIMIS | Public |
| Website | Website of the project | TRIMIS | Public |
| Funding origin | Funding country or European in case of EU funding | TRIMIS | Public |
| Funding Source | Framework programme or funding agency (national projects) | CORDIS / TRIMIS | Public |
| Parent Programmes | Parent programme within which project has been funded | CORDIS / TRIMIS | Public |
| Specific funding programme | Specific programme within which project has been funded | CORDIS / TRIMIS | Public |
| Other Programme | Aggregated call name of within which project has been funded | CORDIS / TRIMIS | Public |
| Call for proposal | Specific call within which project has been funded | CORDIS / TRIMIS | Public |
| Total project cost | Total project budget | CORDIS / TRIMIS | Public |
| Total project cost – Currency | Currency of the project budget | TRIMIS | Public |
| EU Contribution | EU Contribution of the project | CORDIS / TRIMIS | Public |
| Funding Scheme | Funding Scheme within which project has been funded | CORDIS / TRIMIS | Public |
| Background and Policy | Background and policy context of the project | CORDIS / TRIMIS | Website / Internal |
| Strategic objectives | Strategic objectives of the project | CORDIS / TRIMIS | Website / Internal |
| Methodology | Methodology of the project | CORDIS / TRIMIS | Website / Internal |
| Key Results | Key results | CORDIS / TRIMIS | Website / Internal |
| Related Projects | Related projects | TRIMIS | Internal |
| Contact Organisation | Contact / lead organisation | CORDIS / TRIMIS | Public |
| Partner Organisations | List of partner organisations | CORDIS / TRIMIS | Internal |
| Technologies | Technologies investigated within the project | TRIMIS | Public |
| Geo-spatial type | Geo-spatial type of the project | TRIMIS – legacy [6] | Public |
| STRIA Roadmaps | STRIA roadmap(s) / thematic area(s) of the project [1] | TRIMIS | Public |
| Transport mode | Transport mode investigated in the project [2] | TRIMIS | Public |
| Transport policies | Transport policies of the project | TRIMIS – legacy [6] | Public |
| Transport sectors | Transport sector [3] | TRIMIS | Public |
| Published | Date of publication of the project in TRIMIS portal | TRIMIS | Internal |
| Created on | Date project has been included in the TRIMIS database | TRIMIS | Internal |
| Last updated on | Date of the last update of the project's record | TRIMIS | Internal |
| Project Status | Status of the project (ongoing / completed) | TRIMIS | Website / Internal |
| Project url | Project URL in TRIMIS portal | TRIMIS | Website / Internal |

[1] Thematic area covered by a project. Their definition follows STRIA roadmaps: Connected and automated transport (CAT); Transport electrification (ELT); Vehicle design and manufacturing (VDM); Low-emission alternative energy for transport (ALT); Network and traffic management (NTM); Smart mobility and services (SMO); Transport infrastructure (INF).
[2] Transport modes included in the TRIMIS database: road, rail, waterborne, airborne or multimodal.
[3] Transport sectors included in the TRIMIS database: passenger, freight or passenger and freight.
[4] Source of data: CORDIS – data retrieved from CORDIS database; TRIMIS – data collected by TRIMIS project;
[5] Data extracted from CORDIS database. If a project is not included in CORDIS, the field remain empty.
[6] Data collected by TRIMIS project, however the variable will be depreciated or replaced in the next version of the database.
[7] Data availability: Public – data freely available via portal or in publicly available snapshot of the database; Website / Internal – data available via portal but not in publicly available snapshot of the database; Internal – data only available for internal purposes;
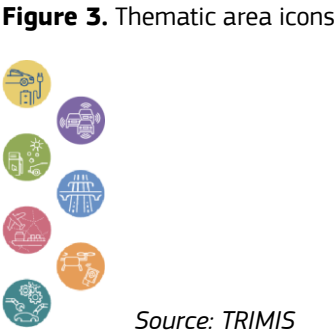
*Source: TRIMIS*

In case of projects funded from the recent research and innovation Framework Programmes (FP7, H2020 and HE), part of the data is retrieved directly from the CORDIS database. This includes basic financial and administrative data (timeframe, funding scheme, budget, EC Contribution or organizations involved in project implementation) as well as a brief project description. However, unlike the CORDIS database which covers all scientific areas, TRIMIS offers a tailored dataset, limited to projects in transport sector. Moreover, TRIMIS enriches the data by adding additional, transport-specific, original variables: transport sector and mode, thematic area, which is in line with Strategic Transport Research and Innovation Agenda (STRIA) roadmap definitions, and technologies investigated within a project. The list of technologies contains nearly 1 000 categories which are then grouped into 48 aggregated technology themes.

— Transport sector:
- passenger transport,
- freight transport,
- passenger and freight transport.

— Transport mode:
- road transport,
- rail transport,
- airborne transport,
- waterborne transport,
- multimodal transport.



**Figure 2.** Transport mode TRIMIS icons

*Source: TRIMIS*
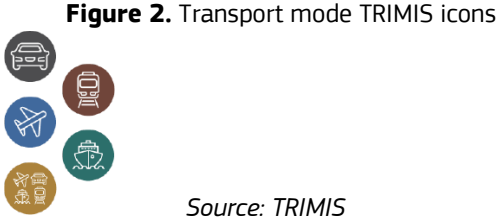
— Thematic area:
- Low-emission alternative energy for transport (ALT),
- Connected and automated transport (CAT),
- Transport electrification (ELT),
- Transport infrastructure (INF),
- Network and traffic management (NTM);
- Smart mobility and services (SMO),
- Vehicle design and manufacturing (VDM),



**Figure 3.** Thematic area icons

*Source: TRIMIS*

Moreover, TRIMIS is also collecting data about projects funded from other sources than research and innovation Framework Programmes. Even though it focuses mostly on open data, its added value is in collection, unification and further dissemination of data which is scattered, diverse and, in some cases, hardly accessible. Projects that are included in the TRIMIS database are both, European (e.g. Interreg, Connecting Europe Facility) as well as national ones (i.e. funded by agencies from Member States). All the data is regularly checked for updates in order to provide an accurate information about the current state of research and innovation activities in Europe.

The procedure of data collection is schematically presented in the Figure 4. In the first step, all relevant projects need to be identified and assessed as having transport in their scope. Then, all relevant information needs to be collected. In case of projects funded within Framework Programmes all the data can be retrieved from one data source (CORDIS database), while in case of other European projects as well as projects funded by Member States, the data need to be collected from scattered sources. Once all the data is included in the TRIMIS database, an editor adds all TRIMIS specific tags (transport mode and sector, thematic area and technologies). After an evaluation of the quality and completeness of data, the project flashcard is published in the TRIMIS portal and made available for a download.

**Figure 4.** TRIMIS data collection scheme

**Data collection scheme**
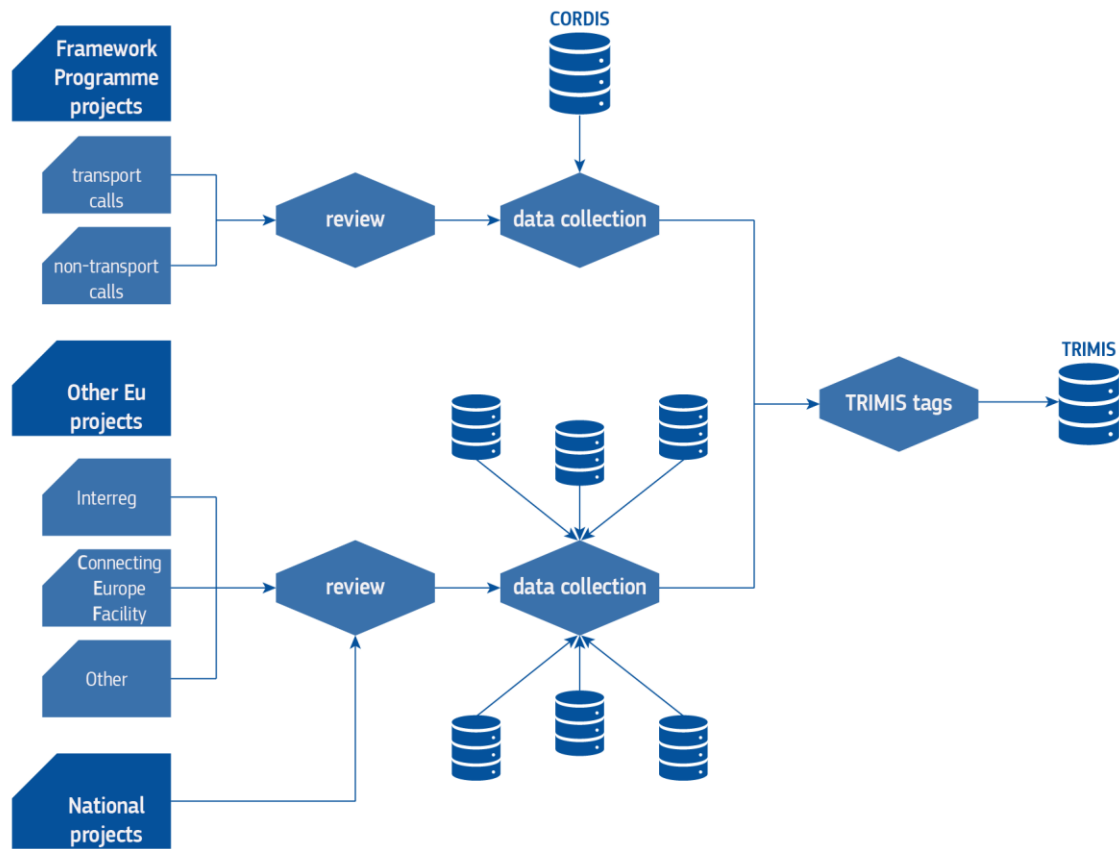


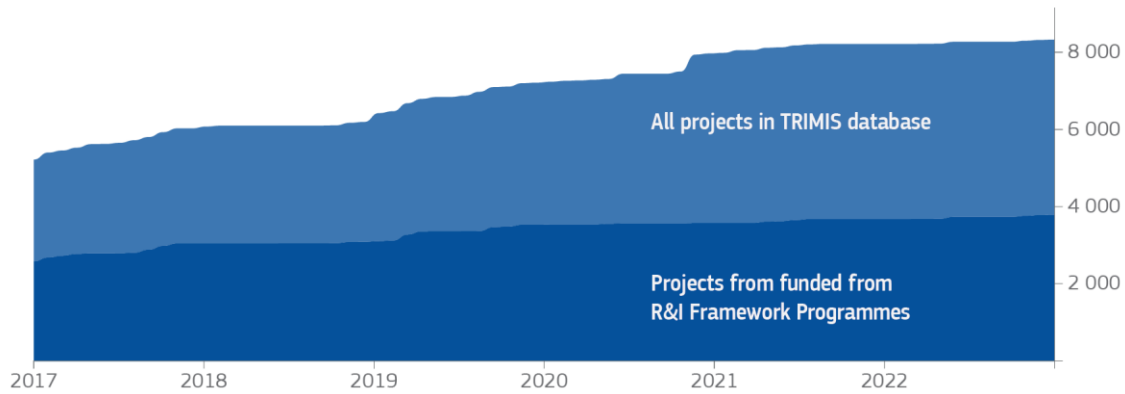*Source: TRIMIS*

## 2.2 Changes in the TRIMIS database

Since the beginning of the TRIMIS project (September 2017) the number of projects included in the TRIMIS database has been gradually increasing (Figure 5). At the end of the year 2022, there were 8 337 projects in the database, which is a 10.0% increase since the previous Status Assessment report which represent a snapshot of the database from 26 November 2020. In total 990 projects were added to the TRIMIS database, while 235 were removed due to cleaning procedures (e.g. duplicates, incomplete or wrong information).

Nearly half of the research and innovation projects in the TRIMIS database are funded within one of the research and innovation Framework Programmes. This share slightly decreased during the development of the database, mainly due to increasing number of other European projects included in the database, notably those funded within Connecting Europe Facility.

Out of 990 projects added to the database during the years 2021 and 2022, the majority come from research and innovation Framework Programmes: FP7 and Horizon 2020. A relatively low number of projects funded from sources from Member States has been added to the TRIMIS database. Nevertheless, nearly a hundred projects have been added, with the majority coming from Spain and Italy (Figure 6). Over a hundred added projects have been funded within the Connecting Europe Facility programme. Additionally, a review of Interreg projects was conducted during the preparation of a previous report, resulting in the addition of 28 relevant projects to the TRIMIS database.

**Figure 5.** Change of the number of projects in TRIMIS database

**Number of projects in the TRIMIS database (January 2017 – December 2022)**



*Source: TRIMIS*

Finally, due to a change of focus, less attention has been paid to adding national projects to the database. In result, relatively low number of projects funded from sources from Member States has been added to the TRIMIS database. Nevertheless, nearly a hundred projects have been added, with the majority coming from Spain and Italy.

**Figure 6.** Type of projects added to TRIMIS database in the years 2021-2022

**The TRIMIS database updates**

Changes in the number of projects in the TRIMIS project database since the previous Status Assessment report
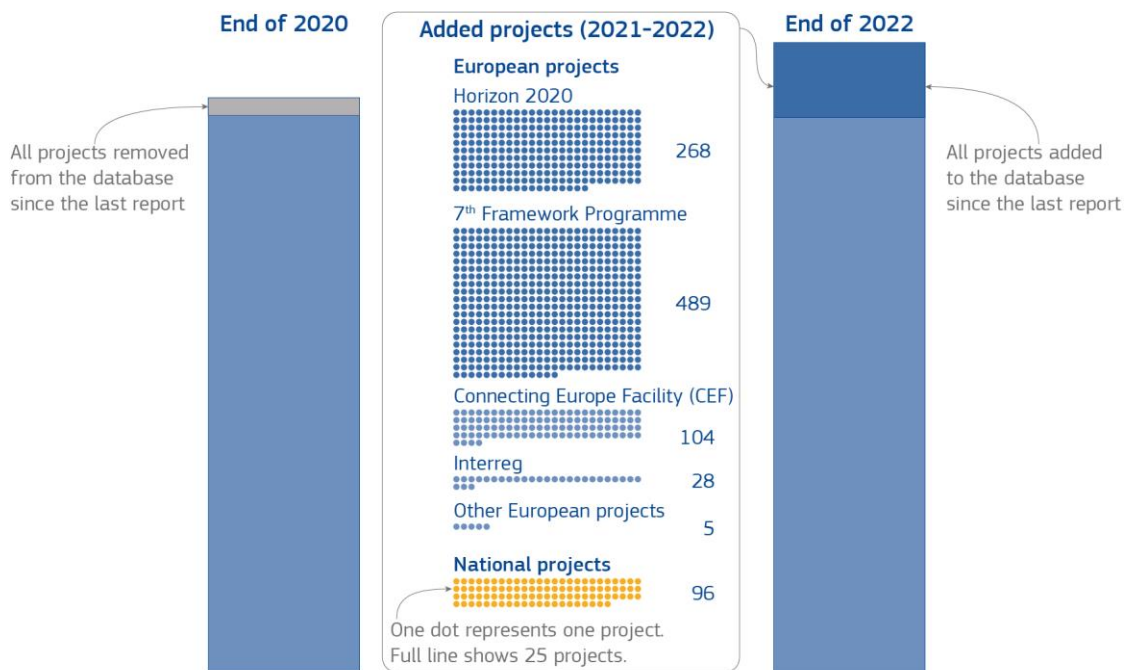


*Note: The figure shows changes in the TRIMIS database in the period from 2020-11 26 to 2023-01-06.*

*Source: TRIMIS*

## 2.3 Database status: type of funding

Almost two-thirds of all projects in the TRIMIS database has been funded by different European programmes, mostly – by subsequent research and innovation Framework Programmes (Figure 7). In total, over half of the projects in the database have been funded from these sources, with Horizon 2020 being the most numerous of them (2001 projects). Apart from research and innovation Framework Programmes, the most common types of projects are those funded by different types of Interreg programme, followed by projects funded by Connecting Europe Facility. Moreover, the TRIMIS database contains nearly three thousand projects funded from national sources.

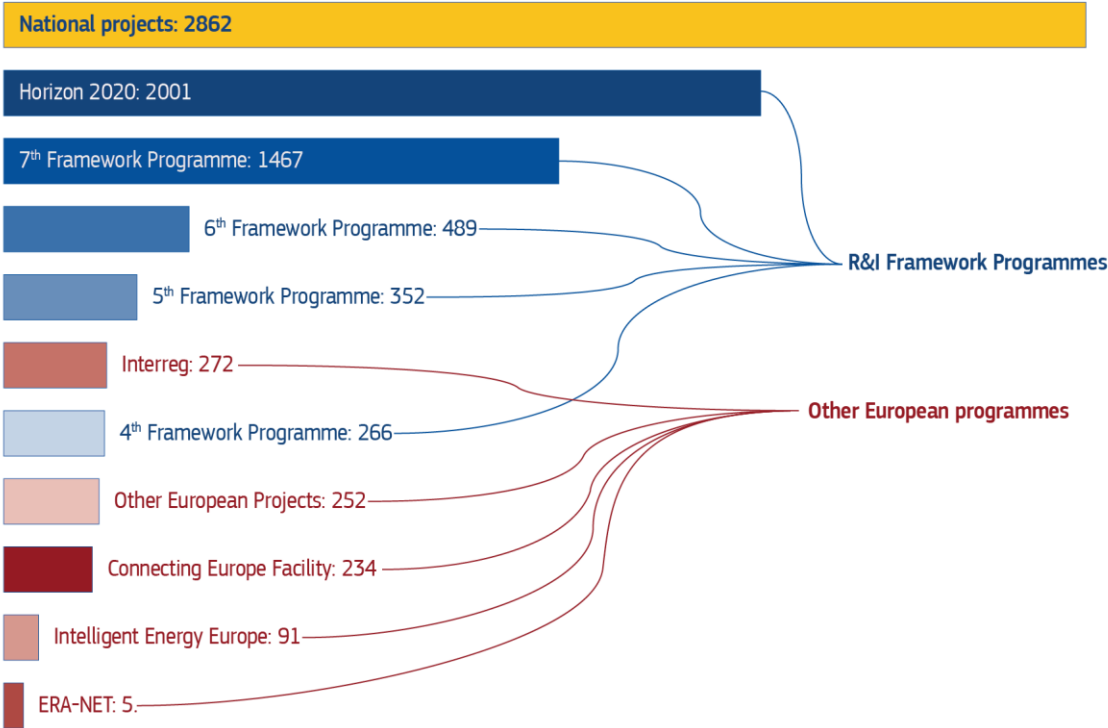During the period covered by this report (2021-2022), the general structure of the funding sources of projects included in the TRIMIS database did not change. There is still a dominance of the recent framework programmes (FP7 with an increase of 50% and Horizon 2020 with around 15% of new projects). However, there is a slight decrease of the importance national projects (just 3.5% increase of the number of projects in the database). The only significant change is related to projects supported by the Connecting Europe Facility programme, as their number almost doubled making it the second most numerous non-research and innovation Framework Programme (after Interreg).

**Figure 7.** Type of funding of projects included in the TRIMIS database (1995-2022)

**Number of active projects by funding type**
In the TRIMIS database



National projects: 2862
Horizon 2020: 2001
7th Framework Programme: 1467
6th Framework Programme: 489
5th Framework Programme: 352
Interreg: 272
4th Framework Programme: 266
Other European Projects: 252
Connecting Europe Facility: 234
Intelligent Energy Europe: 91
ERA-NET: 5

R&I Framework Programmes

Other European programmes

*Source: TRIMIS*
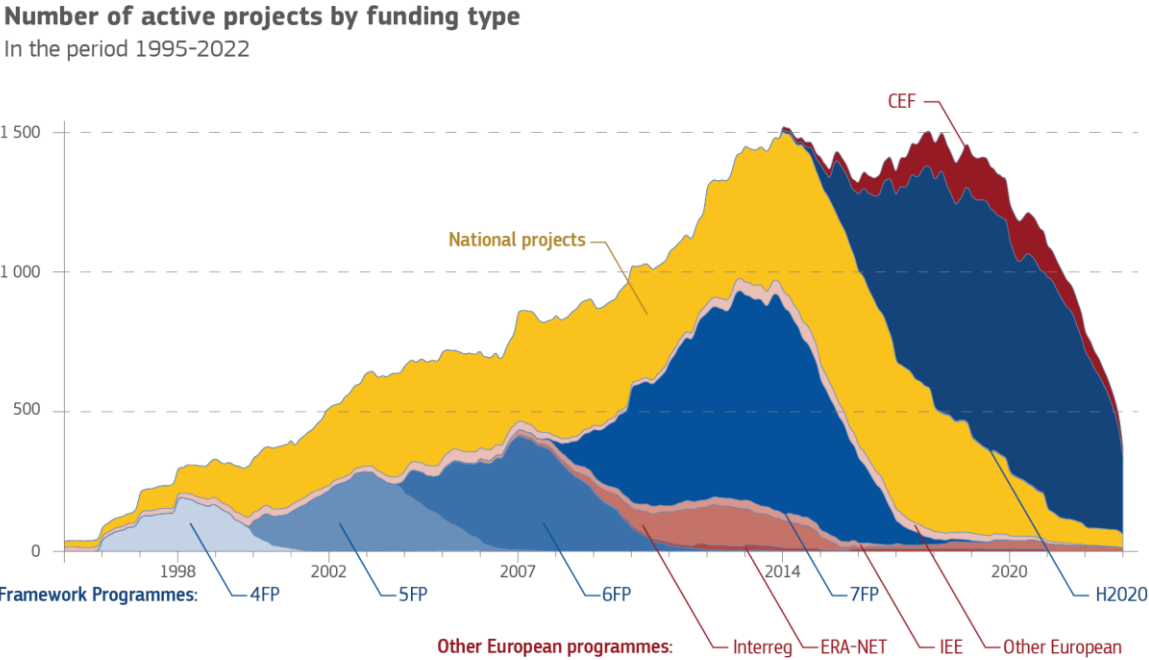
Most of the projects included in the TRIMIS database were implemented in the decade 2010-2022 (Figure 8). This period overlaps with the duration of FP7and Horizon 2020 research and innovation Framework Programmes, which constitute main share of all the projects in the database. Moreover, the duration projects funded from national sources are in general evenly distributed, with relatively

less projects being implemented in the period covered by this report. This is partly because of the slight modification of priorities of TRIMIS, which first of all concentrated on extending the database by inclusion of European projects rather than national ones.

In case of older projects, we can observe a domination of projects funded within the subsequent research and innovation Framework Programmes (visible on the chart FP4-FP7 and H2020). The number of projects increases with time which might be also related to better data coverage by the TRIMIS database in the more recent years.

**Figure 8.** Duration and type of funding of projects included in the TRIMIS database (1995-2022)



**Number of active projects by funding type**
In the period 1995-2022

*Note: FP – Framework Programme; CEF – Connecting Europe Facility, IEE – Intelligent Energy Europe;*
*Source: TRIMIS*

## 2.4 Database status: European projects and EU contribution

The EU contribution of projects included in the TRIMIS database ranges from a few dozen thousand euros to nearly 250 million euros (Figure 9). In case of Horizon 2020 there is a significant number of SME-1 projects (389 projects) with a lump sum of EU contribution of 50 000 EUR which small and medium size organizations may spend on development of business concept and feasibility study. On the other extreme, there are five Horizon 2020 projects (LPA GAM 2018, ENG GAM 2018, GAM-2020-LPA, GAM AIR 2018 and SYS GAM 2018) and one project funded within Connecting Europe Facility ([4]) with EU contribution exceeding 100 million EUR. Nevertheless, most of the projects received European support worth between one and ten million of euro.

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[4] National Road Traffic Management System on the TEN-T network - Phase I;
https://trimis.ec.europa.eu/project/national-road-traffic-management-system-ten-t-network-phase-i
https://ec.europa.eu/assets/cinea/project_fiches/cef/cef_transport/2015-PL-TM-0093-W.pdf

The total scale of average monthly EU contribution was the highest between the years 2018 and 2021 (Figure 10), a bit later then a pic of to the number of active projects (Figure 8). This might be associated to the fact that in the TRIMIS database there is more projects funded within Horizon 2020 than from the previous Framework Programmes. Moreover, the majority of projects with the highest EU contribution were implemented in the last years. The highest average total monthly EU contribution during 6th and 7th Framework Programmes was quite similar (around 2 billion euro; Figure 10), while in case of Horizon 2020 this value doubled (at the end of 2019 and beginning of 2020). Finally, the highest value of EU contribution in Connecting Europe Facility projects was noted in the years 2020-2021.

**Figure 9.** EU Contribution in projects in the TRIMIS database



*Source: TRIMIS*
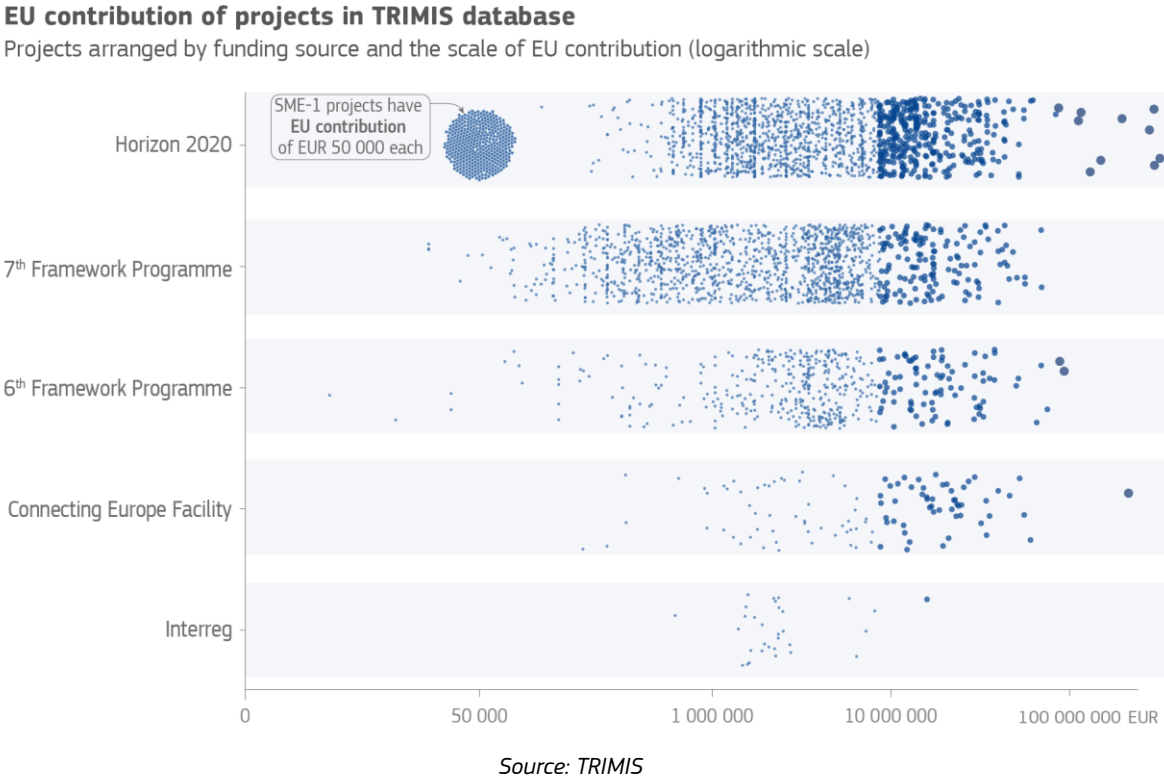
**Figure 10.** EU Contribution in time by type of project (2008-2022)
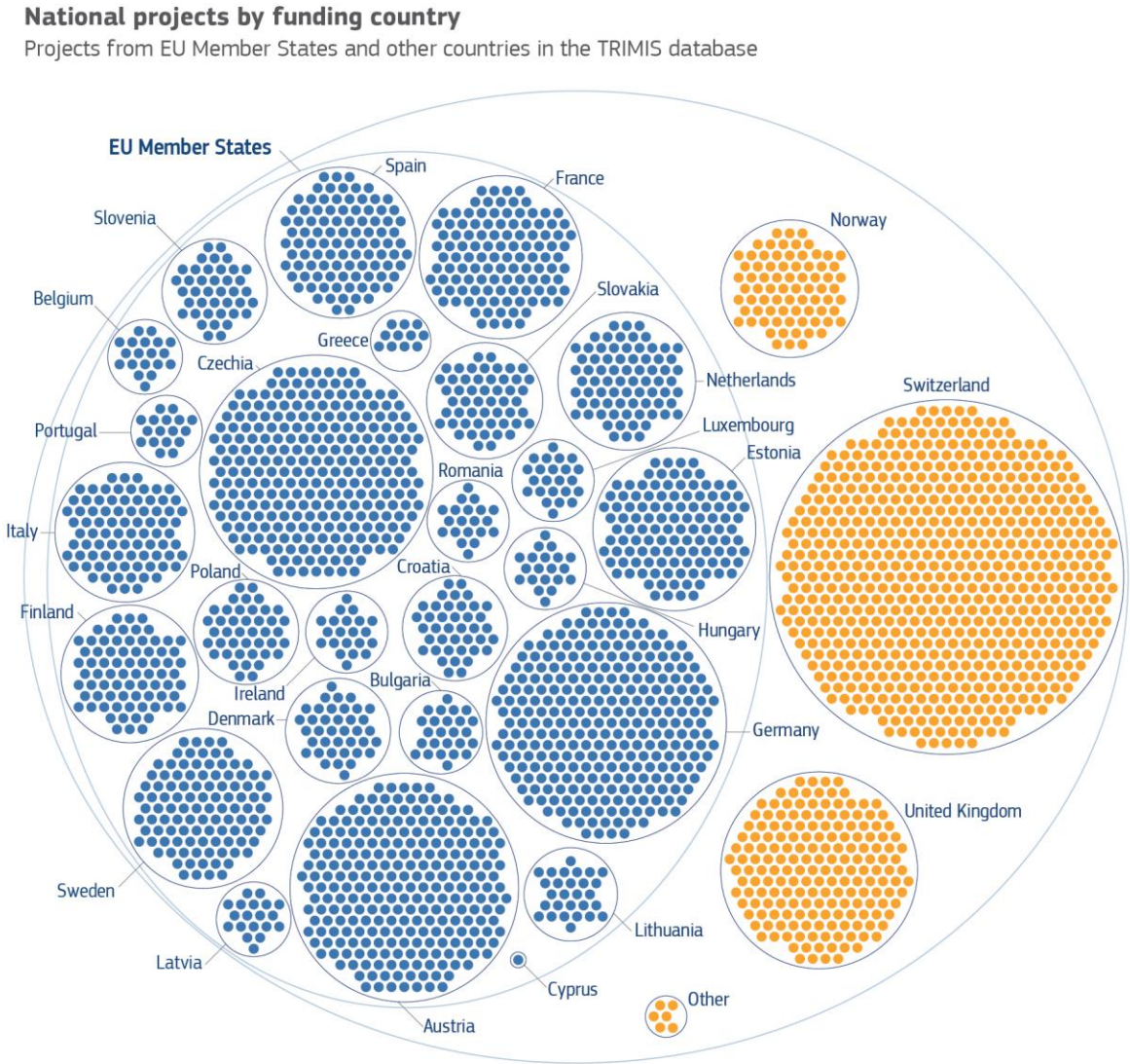


*Source: TRIMIS*
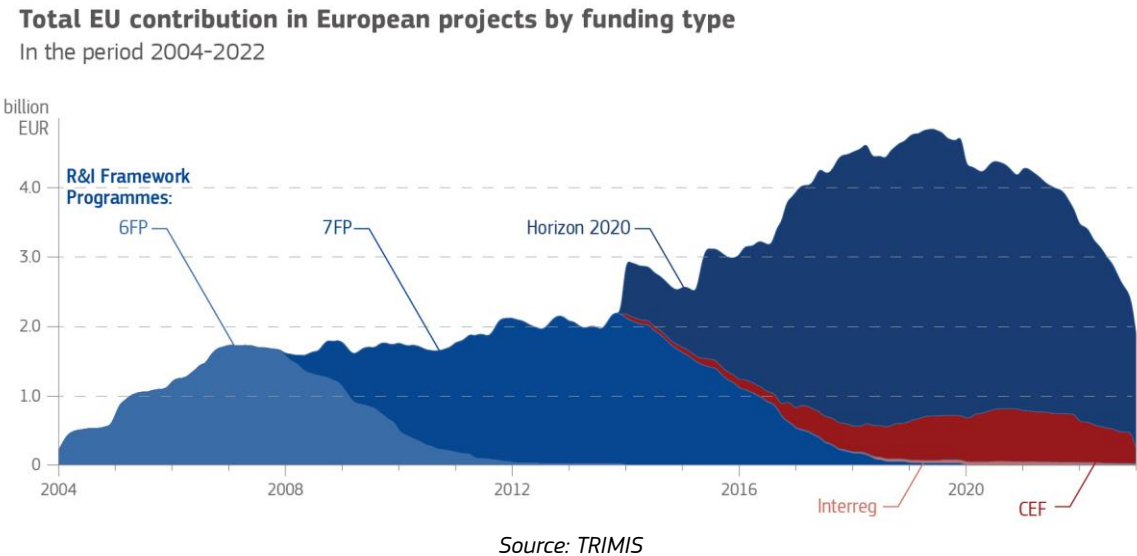
## 2.5  Database status: national projects

In the TRIMIS database, there are 1875 projects funded by the EU Member States (only Malta does not have any project in the database) and nearly 900 funded from other, non-EU countries (Figure 11). The biggest amount of national projects is funded by different Swiss funds (over 600). Among EU national projects, the highest number comes from Germany, Czechia and Austria (279, 261 and 250, respectively).  This by no means represents the complete picture of the country situation at EU and non-EU level. European national research and innovation transport projects are continuously monitored and reported but their full coverage is not within the remit of the TRIMIS project.
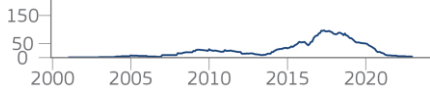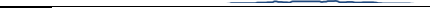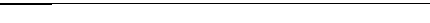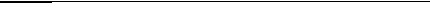
**Figure 11.** National projects by funding country



**National projects by funding country**
Projects from EU Member States and other countries in the TRIMIS database

*Source: TRIMIS*

The Table 2 presents a summary of national projects funded by EU Member States included in the TRIMIS database. It presents the total number of projects in the database and the date of its last update of the information coming from particular country (i.e. an addition of a project or an update of project's data). Additionally, it contains a set of simplified charts showing time when the projects from a country were implemented.

**Table 2.** National projects from EU Member States in the TRIMIS database

| Country | Number of projects | Last update | Active projects over time |
|---|---|---|---|
| Austria | 250 | 2022-11-30 | |
| Belgium | 19 | 2020-01-14 | |
| Bulgaria | 25 | 2019-10-10 | |
| Croatia | 40 | 2019-10-10 | |
| Cyprus | 1 | 2019-10-10 | |
| Czechia | 261 | 2021-11-10 | |
| Denmark | 38 | 2022-12-08 | |
| Estonia | 116 | 2022-12-08 | |
| Finland | 75 | 2020-01-10 | |
| France | 114 | 2022-08-17 | |
| Germany | 279 | 2022-08-17 | |
| Greece | 11 | 2019-10-10 | |
| Hungary | 23 | 2019-10-10 | |
| Ireland | 20 | 2019-10-10 | |
| Italy | 84 | 2022-12-16 | |
| Latvia | 19 | 2022-12-08 | |
| Lithuania | 28 | 2019-10-10 | |
| Luxembourg | 21 | 2021-11-10 | |
| Netherlands | 75 | 2022-08-17 | |
| Poland | 42 | 2019-10-10 | |
| Portugal | 17 | 2019-10-10 | |
| Romania | 20 | 2019-10-10 | |
| Slovakia | 52 | 2021-11-10 | |
| Slovenia | 40 | 2019-10-10 | |
| Spain | 99 | 2022-11-17 | |
| Sweden | 106 | 2022-08-16 | |

*Source: TRIMIS*

The table presents the summary of information about research and innovation projects supported from national funds in 26 Member States – all, but Malta, as there are no projects from this country in the database. Additional data about research and innovation projects from ten EU countries was added in 2022 and from three more countries – in 2021. Moreover, projects funded from national sources in Switzerland and United Kingdom were also included in the TRIMIS database in 2022, while Norwegian projects were included in 2021 (Table 3). In case of the other countries, there were no updates in the period covered by this report. Due to the difficulty to monitor and update national research and innovation projects, since 2020 the focus of the TRIMIS database has been mostly dedicated to the EU funded projects, while data collection about nationally funded projects has continued as secondary activity of TRIMIS.

**Table 3.** National projects from non-EU Member States in the TRIMIS database

| Country | Number of projects | Last update | Active projects over time |
|---------|-------------------:|-------------|---------------------------|
| Bosnia and Herzegovina | 1 | 2019-10-10 |  |
| Iceland | 4 | 2019-10-10 |  |
| Norway | 76 | 2021-11-10 |  |
| Serbia | 1 | 2019-10-10 |  |
| Switzerland | 626 | 2022-08-18 |  |
| United Kingdom | 182 | 2022-08-18 |  |

*Source: TRIMIS*

Apart from national research and innovation projects from EU and non-EU countries, in the TRIMIS database there are 97 projects under "International" category. These are projects funded mostly by the International Union of Railways or by World Road Association (Permanent International Association of Road Congresses – PIARC). They were added to the database in the 2019. These projects had an implementation period mostly between the years 2002 and 2019.

## 2.6 Database status: transport modes

One of the steps of adding the project to the TRIMIS database is to add a transport mode tag to it. One project can be linked to only one transport mode, and if more than one modes are under investigation in the project, then it is tagged as "multimodal". Nevertheless, there are still around 500 projects (6.4% of all projects in the database) that are missing this tag. It mostly affects the oldest projects and this information is successively supplemented.

Figure 12 shows the distribution of projects by a transport mode they are researching. The highest share of research and innovation projects concentrate on road transport – over third part of them, followed by airborne transport (26.2%). Clearly less attention is directed towards rail and waterborne transport. Over one-fifth of projects cover more than one transport mode in their activities.

**Figure 12.** Number of projects by transport mode and its recent changes

**Number of projects in the TRIMIS database by transport mode**

TRIMIS tags projects with specific transport modes or as multimodal if they investigate multiple modes.



| Multimodal transport | Road transport | Airborne transport | Waterborne transport | Rail transport |
|---|---|---|---|---|
| 1759 | 2793 | 2041 | 617 | 593 |
| 22.5% | 35.8% | 26.2% | 7.9% | 7.6% |
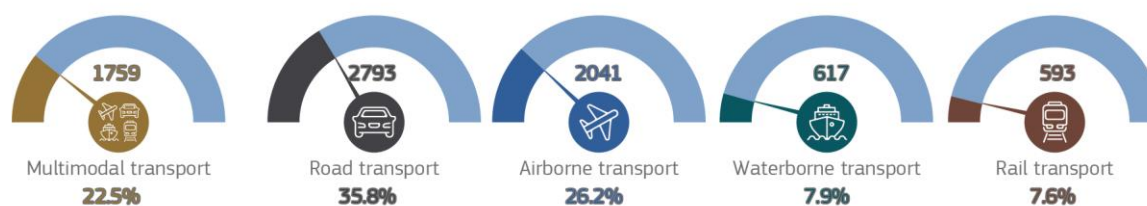
*Source: TRIMIS*

## 2.7 Database status: thematic areas

One of the added value of the TRIMIS database are specific tags which shows which thematic area (or areas) a project covers. Those thematic areas are defined based on scope of roadmaps of Strategic Transport Research and Innovation Agenda:

— Low-emission alternative energy for transport (ALT);

— Connected and automated transport (CAT);

— Transport electrification (ELT);

— Transport infrastructure (INF);

— Network and traffic management (NTM);

— Smart mobility and services (SMO);

— Vehicle design and manufacturing (VDM).

Around 85% of projects in the database are focusing on one or more identified thematic areas. The *Vehicle design and manufacturing* is the most commonly investigated topic – over one-third of projects with defined thematic areas covers this topic (Figure 13). The next most commonly researched thematic areas are *Network and traffic management* (almost 2000 projects), *Smart mobility and services* and *Transport infrastructure* (between 1200 and 1400 projects each). Moreover, at the end of the year 2022, 1285 projects had no thematic area indicated. This number covers both, missing data as well as projects whose scope does not fall under any of the defined thematic areas.

The *Vehicle design and manufacturing* is also the area in which case the number of projects increased the most in the period covered by this report (over 600 added projects, a 32% increase). The number of projects covering *Low-emission alternative energy for transport* also increased significantly (nearly a 40% of increase), however in this case the absolute number of projects is still the lowest among all thematic areas (an increase from 405 to 556 projects). On the contrary, the change in the number of projects investigating *Smart mobility and services*, as well as *Connected and automated transport*, since the last Status Assessment report, was hardly noticeable (less than a 5% of increase of number of projects).

**Figure 13.** Number of projects by STRIA roadmaps and its recent changes

**Number of projects by thematic area**
and their change in the period 2021-2022



| | | |
|---|---|---|
| ALT | | 556 |
| CAT | | 820 |
| ELT | | 799 |
| INF | | 1243 |
| NTM | | 1994 |
| SMO | | 1363 |
| VDM | | 2492 |

*Number of projects at the end of 2022*
*Number of projects at the end of 2020*
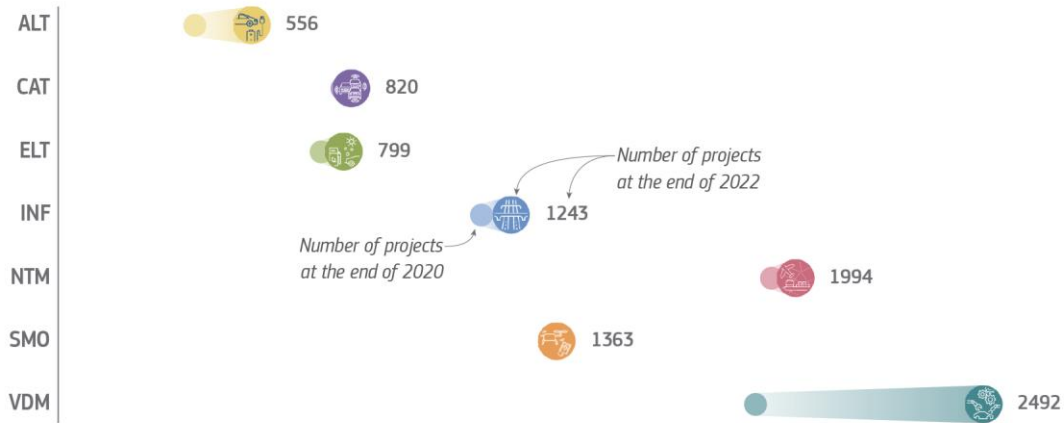
*Thematic areas are equivalent to roadmaps of Strategic Transport Research and Innovation Agenda.*
*One project may cover one or multiple roadmaps. Projects with no roadmap identified are excluded from the chart.*

*Source: TRIMIS*

The Figure 14 shows existing synergies between thematic areas. Each radar chart shows a synergy between a particular strategic area and the remaining ones. The number next to the orbiting thematic area icon indicates number of projects focusing exclusively on the main strategic area. The length of each bar shows how many projects cover both the main and the selected areas. The bars follow the same order as shown in the legend. The length of the bar depends on the scale of synergies between two particular thematic areas as well as their popularity among all projects in the database.

The highest number of projects which cover at least a pair of different thematic areas concentrates jointly on *Smart mobility and services* and on *Network and traffic management systems* (380 projects). Other pairs that are commonly researched together are *Connected and automated transport* with *Network and traffic management systems* (310 projects), *Transport electrification* with *Vehicle design and manufacturing* (260 projects), and *Transport infrastructure* with *Network and traffic management systems* (248 projects). On the other side, the lowest number of projects worked on synergies between *Low-emission alternative energy* with *Connected and automated transport* (only 9 projects) and *Low-emission alternative energy* with *Network and traffic management systems* (14 projects). Also a combination of *Transport electrification* and *Network and traffic management systems* and *Smart mobility and services* with *Vehicle design and manufacturing* has gained relatively low attention (23 and 26 projects, respectively).

**Figure 14.** Synergies between thematic areas

**The scale of synergies between thematic areas**
The number of projects which jointly cover at least two thematic areas



Low-emission alternative energy (ALT)

Connected and automated transport (CAT)

Transport electrification (ELT)

Transport infrastructure (INF)

Network and traffic management systems (NTM)

Smart mobility and services (SMO)

Vehicle design and manufacturing (VDM)

Legend

Number of projects which covers both, ALT and ELT thematic areas

Number of projects

Directions of thematic areas

Number of projects which covers exlusively ALT thematic area

*Source: TRIMIS*

Figure 15 uses the data presented on figures 13 and 14 and it allows to determine the proportion of projects that exclusively focus on a specific thematic area. *Vehicle design and manufacturing* is the thematic area which has the highest share of monothematic projects (71.7%). On another extreme there is *Transport electrification* with the number of projects concentrating exclusively on this topic slightly exceeding one-third of all projects covering this topic. In general, thematic areas with the lowest total number of projects (apart from *Transport electrification* also *Low-emission alternative energy* and *Connected and automated transport*) are those that have lower share of monothematic projects. The remaining thematic areas have a share of thematic concentration between 50 and 60 percent.

**Figure 15.** Thematic concentration



**Thematic concentration**
Share of projects that exclusively focused on a specific thematic area out of all projects covering this thematic area
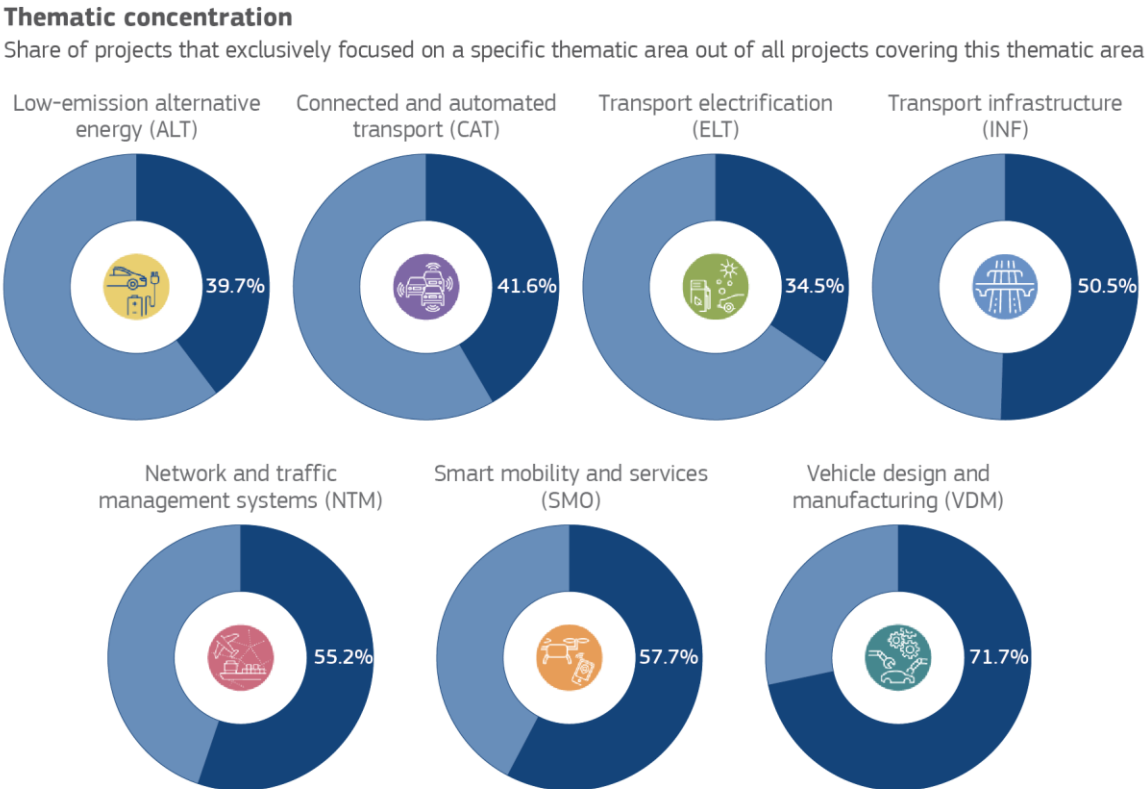
*Source: TRIMIS*

## 2.8  Database status: technologies

One of the main feature of the TRIMIS database is a technologies repository. This facilitates the comparison and analysis of various fields of transport innovation. The scope of each project is evaluated in terms of technologies the project is covering. Moreover, target technology readiness level (TRL) is established for each of identified technologies. In order to simplify the complex picture and reflect the uncertainty involved in being overly precise with the allocation of a TRL, the original 9-step TRL classification, as introduced by the United States' National Aeronautics and Space Administration (Héder, 2017), was replaced with an aggregated classification which distinguishes four subsequent levels. This change was made due to the limited information usually available for the status of the technologies being researched by a project and to facilitate comparisons. Figure 16 shows the four

TRIMIS development phases, and their relationship to the NASA TRL scale which helps to visually confront both classifications and facilitate comparisons between them.

**Figure 16.** Technology readiness level
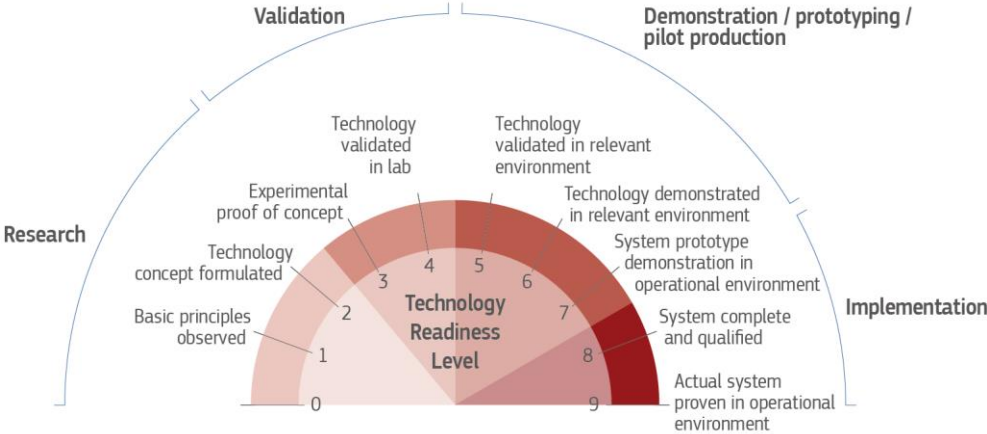


Source: TRIMIS

A comprehensive methodology has been developed in order to identify emerging technologies within the TRIMIS database. The process of their identification and matching them to the scope of particular project is schematically presented on the Figure 17. It consists of several phases. It starts with project identification. In order to add a project to the TRIMIS database, the scope of the project is verified for relevance. Then the project description is reviewed in-depth in order to identify transport technologies which are investigated or developed during the project implementation. The identified technology or technologies are then referred to the TRIMIS technology database. If there is a new technology developed within the scope of the project or projects, this new technology is added to the database. This enable to keep the database up-to-date and track as well new and emerging technologies in the transport sector.

The final step of the workflow is the allocation of the development phase for each of technologies identified within the scope of a project. Once the process is finished, the database is ready to be further analysed and the results are then presented in Science for Policy reports, briefs and other TRIMIS outputs. The main TRIMIS deliverable which contains technology assessment is the Science for Policy report on New and emerging transport technologies and trends (NETT) in European research and innovation projects (e.g. Gkoumas et al., 2020) and scientific publications (Gkoumas and Tsakalidis, 2019; Gkoumas, van Balen, et al., 2022).

The result of the workflow is two-fold. First, the TRIMIS database of technology is complete and contains all technologies previously existing in the database as well as all new and emerging technologies identified during the review of scope of projects that are being added to the TRIMIS project database. Second, all the projects in the database contains a specific tag with technology or technologies the project is working on, and all technologies contains also information about their TRIMIS technology development phase. The latter is an aggregated version of technology readiness level. In consequence, both datasets, may be further used and analysed in the TRIMIS project activities.

**Figure 17.** Identification of technology themes in projects
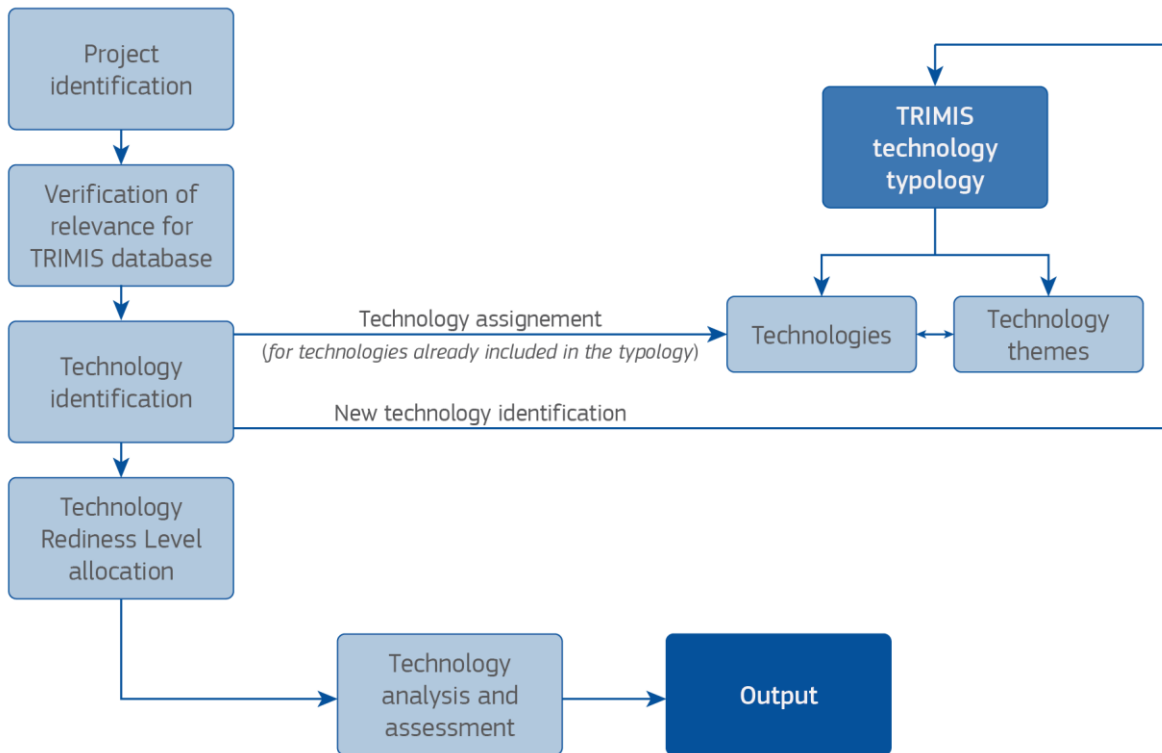


*Source: TRIMIS based on (Gkoumas et al., 2019)*

The list of technologies included in the TRIMIS database currently contains over 900 positions which are grouped into 48 aggregated technology themes: 20 themes associated directly to one of four specific transport modes (Figure 18) or 28 transversal topics which contains technologies which can be of use in any of the four transport modes. Both figures are based on the project taken from the TRIMIS database which has started since the beginning of the year 2008, which is an equivalent of the beginning of the seventh Framework Programme. The data presented below is extracted from nearly 6000 research and innovation projects and respective technologies and technology themes.

In the airborne transport, three technology themes contain 122 technologies. They have been investigated in nearly thousands of projects and *Aircraft design model* being the most commonly a subject of research and innovation activities. In case the rail transport, there are also three general technology themes which grouped 35 technologies in total. Road transport has the most diverse technologies, 145 in total which are then grouped into ten technology themes. *Public charging infrastructure* was the one which was the most commonly investigated (60 projects). The list of technology themes for waterborne transport contains four positions with two being more commonly studies than the others: *Ship design and manufacturing* (29 technologies being subject of 53 projects) and *Ship propulsions* (24 technologies and 42 projects).

**Figure 18.** Transport modes, technology themes and main technologies

**Technology themes for transport modes**
and top technologies within every theme

| Top technology | Technologies by number of projects | Technology themes (Total number of projects) | Transport mode |
|---|---|---|---|

Aircraft design model — 66 — Aircraft design and manufacturing (525)

Drone traffic management system — 37 — Aircraft operations and safety (241)

Counter rotating open rotor engine — 26 — Aircraft propulsion (213)

Airborne

Rail operations (80)
Rail
Rail vehicle design (38)
Rail vehicle propulsion (1)

28 — Transport Management and Control System (TMCS)
9 — More efficient rail wagons
Electricity usage and storage for last mile propulsion

Public charging infrastructure — 60 — Electric road vehicles (225)

Parking management system — 22 — Road and traffic management systems (77)

Energy efficient transmission — Road vehicle propulsion (60)

ADAS learning and harm prevention platforms — 19 — Advanced driver assistance systems (59)

Mobility as a Service model — 15 — Mobility as a Service - MaaS (32)

Novel gearbox concepts — Road vehicle design and manufacturing (30)

Communication network for intelligent mobility — 20 — Road vehicle operations (27)

Electromobility platform — EV support technologies (23)

Measures to promote cycling — Cycling measures (11)

Alternative asphalt manufacture — Road structures (9)

Road

Waterborne
Ship design and manufacturing (53) — Hull design optimisation
Ship propulsion (42) — Electric propulsion system for vessels
Ship operations (7) — Vessel allocation decision support tool
Ship design and construction (3) — Ship design for future retrofitting of technologies

*Source: TRIMIS*

Nearly half of the general technology themes are transversal one, which means that the technologies may be implemented for multiple transport mode solutions. In total, eighteen technology themes group over five hundred detailed technologies. *Infrastructure management* and *Safety systems* alone

group 51 technologies each. Both of them have been covered by the scope of over two hundred projects implemented since 2008 (270 and 203, respectively). However, the most commonly technology theme is *Information systems*, in which case one of its 28 detailed technologies have been covered by the scope of 287 projects. The most popular detailed technologies from the transversal technology themes are *ICT support system for multimodality* (71 projects) and *Multimodal border management technologies* (58 projects) followed by *Collaborative logistic ecosystem* (52 projects).

**Figure 19.** Transversal technology themes and main technologies – part A

**Tranversal technology themes**
and top technologies within every theme

| Technology themes (Total number of projects) | Technologies by number of projects | Top technology |
| --- | --- | --- |

Information systems (287) — 71 — ICT support system for multimodality

Infrastructure management (270) — 58 — Multimodal border management technologies

Safety systems (203) — 33 — Technologies to improve road safety

Alternative fuels (160) — 48 — LNG refuelling station

Connected and automated vehicles (149) — 38 — Autonomous vehicle technologies

Electric vehicle batteries and energy management (145) — 16 — Lithium-ion batteries with novel anode/cathode materials

Freight transport technologies (135) — 52 — Collaborative logistics ecosystem

Composite materials (130) — 48 — Composite materials for structural purposes in the aircraft

Sustainable urban mobility plans (128) — 25 — Field demonstrations of sustainable urban mobility

Fuel cells and hydrogen fuel (126) — 16 — Aircraft design model

*Source: TRIMIS*

**Figure 20.** Transversal technology themes and main technologies – part B

**Tranversal technology themes**
and top technologies within every theme

| Transport mode | Technology themes (Total number of projects) | Technologies by number of projects | Top technology |
|---|---|---|---|

Computer-aided design and engineering (119) — Improvement of transition-prediction tools for future laminar flow aircraft

Sensor technologies (114) — Integrated sensors for structural components

Manufacturing processes (112) — Smart composite manufacture

Noise testing, modelling and reduction (95) — Sensor condition monitoring system

Additive manufacturing (65) — Additive Layer Manufacturing

Condition monitoring (52) — Sensor condition monitoring system

Emissions control systems (48) — Air quality measurements

Cabin and cockpit design (46) — Cockpit-based technologies for improved pilot workflow

Satellite navigation (37) — GNSS/EGNOS GSM module

Life cycle analysis (33) — End of life recycling technologies

Energy efficiency (29) — Waste heat recovery system

Non destructive testing (29) — Extended NDT for CFRP structures and bonds

AI, Big Data management and decision support frameworks (18) — Digital transformation of rail operations

Electromagnetic fields (8) — Electromagnetic fields design, simulation and measurement

Fuel flexible engines (7) — Dual fuel engine

HVAC (6) — Advanced thermal storage using phase change materials

Nanomaterials (4) — Nanomaterials for structural health monitoring

Border control technologies (1) — Enhancement of the Automated Border Control gates system

*Source: TRIMIS*

Table 4 presents top ten the most investigated technologies in the TRIMIS project database limited to projects that had been started since the beginning of the year 2008. Most of the technologies are transversal and can be implemented for any of transport mode, however some of them are applicable only for selected one, e.g. *Aircraft design model*.

Projects that investigated most of the top technologies were funded from Framework Programmes. However, in two cases, *Public charging infrastructure* and *LNG refuelling station*, the majority of projects were supported from other European programmes. Moreover, in case of *Transport research and innovation strategies* nearly 30% of projects were funded from national sources.

*ICT support system for multimodality* is a subject of 71 research projects which received over 134 million EUR. Most of the projects were funded within Framework Programmes, however five of them from other European programmes and ten – from national sources. 66 research and innovation projects that focused on the second most popular technology, *Aircraft design model*, received the highest total EU contribution – over 442 million EUR (slightly below 400 million EUR, if the EU contribution was calculated proportionally in case of projects that covered more than one technology). All these 66 projects were funded within research and innovation Framework Programmes.

**Table 4.** Top ten technologies in the TRIMIS database

| Technology[1] | EU contribution | | Number of projects | | | |
|---|---|---|---|---|---|---|
| | Total[2] | Proportional[3] | Total | FP[4] | Other European | National |
| ICT support system for multimodality | 134.3 (14) | 129.0 | **71** | 56 | 5 | 10 |
| Aircraft design model | 442 | 398.4 | **66** | 66 | 0 | 0 |
| Transport research and innovation strategies | 151.3 (24) | 107.0 | **61** | 38 | 6 | 17 |
| Public charging infrastructure | 198.2 (34) | 150.3 | **60** | 16 | 44 | 0 |
| Multimodal border management technologies | 153.7 | 149.2 | **58** | 56 | 2 | 0 |
| Collaborative logistics ecosystem | 169.2 (8) | 149.5 | **52** | 43 | 2 | 7 |
| Composite materials for structural purposes in the aircraft | 212.1 | 207.8 | **48** | 48 | 0 | 0 |
| Development of new Fuel Cells and Hydrogen (FCH) technologies | 168.2 (3) | 144.9 | **47** | 43 | 3 | 1 |
| LNG refuelling station | 193.2 (25) | 130.1 | **47** | 1 | 46 | 0 |
| Power electronics | 24.5 | 18.6 | **41** | 41 | 0 | 0 |

[1] *The table includes projects that have started since January the 1st, 2008.*

[2] *The value in the brackets indicates the number of projects for which the TRIMIS database doesn't cover information about their budget and EU contribution.*

[3] *For projects that cover more than one technology, the EU contribution is distributed proportionally.*

[4] *FP – projects funded within Framework Programmes (7th Framework Programme or Horizon 2020).*
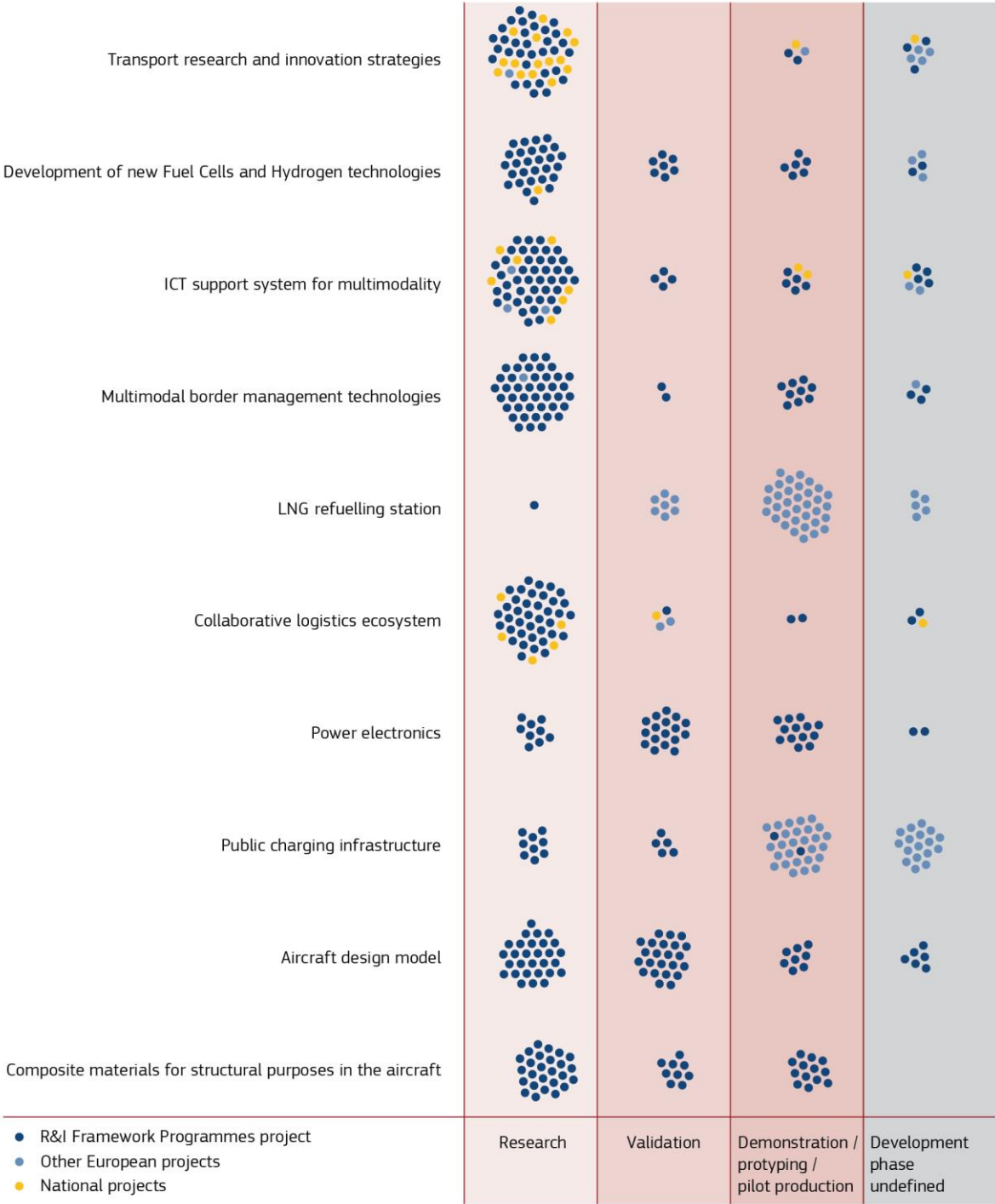
*Source: TRIMIS*

Figure 21 shows the distribution of projects within each of the top ten technologies by their development phase. Most of the projects focused on the first research phase, and none of the identified projects concentrated on the implementation of the technology. However, there are two

technologies which are exceptions. In case of *Public charging infrastructure* and, in particular, *LNG refuelling station* most of the projects worked on technologies in the demonstration and pilot production phase. In both cases it might be also linked to funding coming from programmes other than research and innovation framework ones.

**Figure 21.** The most investigated technologies and their technology readiness level

**Top ten technologies by development phase**
Number and type of projects which investigated one of the top 10 technologies



| | Research | Validation | Demonstration / protyping / pilot production | Development phase undefined |

Legend:
- R&I Framework Programmes project
- Other European projects
- National projects

*Source: TRIMIS*

# 3 Science for Policy analyses

In the years 2021-2022 TRIMIS has prepared and published several Science for Policy analyses. The first group of publications was dedicated to transport research and innovation for particular transport modes (see section 3.1): aviation (Marques dos Santos et al., 2021), rail (Gkoumas, Marques dos Santos, Stepniak, Ortega Hortelano, et al., 2021) and waterborne (Grosso, Marques, et al., 2021). The second group focused on a specific, transport related topic (see section 3.2), including car sharing (Ortega Hortelano et al., 2022), public transport (Stepniak et al., 2022) and urban mobility and logistics (Gkoumas et al., 2022) supplemented by the updated report on Strategic Transport Research and Innovation Agenda (STRIA) roadmap on low-emission alternative energy for transport (Ortega Hortelano et al., 2021). Additionally, the outcome of TRIMIS analytical works were published as an event-related brief (Marques et al., 2022), horizon scanning (Tsakalidis, 2021) and several papers published in scientific journals.

## 3.1 Transport mode research and innovation assessment reports

A series of assessment reports dedicated to research and innovation in the area of particular transport mode was published in 2021 (Figure 22). The series include:

— for the airborne transport: *European research and innovation in aviation emissions reduction* (Marques dos Santos et al., 2021);

— for the rail transport: *Rail transport research and innovation in Europe* (Gkoumas, Marques dos Santos, Stepniak, Ortega Hortelano, et al., 2021);

— for the waterborne transport: *Waterborne transport in Europe – the role of research and innovation in decarbonisation* (Grosso, Marques, et al., 2021).

**Figure 22.** TRIMIS transport mode assessment reports



*Source: TRIMIS*

All the reports are based on the research and innovation projects included in the TRIMIS database with a focus on a specific transport mode. The reports cover both quantitative and qualitative analyses. Each report starts with a state of play in the research and innovation in a given transport mode. It follows with an overview of a policy background which is then followed by quantitative assessment of research. Then, for each of identified main subtheme of research and innovation an in-depth review of main developments is presented, covering main achievements, implications for future research and implications for future policy development. The reports include also insights from academia and industry using quantitative analyses of scientific publications and patents.

## 3.2 Research and innovation assessment thematic reports

In the 2022 three thematic assessment reports were published (Figure 23):

— Research and innovation in car sharing in Europe (Ortega Hortelano et al., 2022);

— Public transport research and innovation in Europe (Stepniak et al., 2022);

— Research and innovation in urban mobility and logistics in Europe (Gkoumas et al., 2022).

**Figure 23.** TRIMIS thematic assessment reports



*Source: TRIMIS*

Similar to the transport mode projects, the reports start with the description of the policy background which is then followed by quantitative assessment of relevant research and innovation projects. The assessment covers such areas as source and scale of funding, main subthemes of the research or key actors (project partners and project coordinators). The main part of the reports is dedicated to the in-depth, qualitative assessment of project achievements. Their description starts with state-of-the-art and a placing research and innovation activities in a broader context, followed by analysis of key achievements and concluded with implications for future research and policy development.

In case of public transport and urban mobility and logistics, the report is accompanied by the short (4-page long) Science for Policy brief (Figure 24). It is an extract from the report with report highlights and key takeaways directed mostly towards decision makers.

Figure 24. TRIMIS Science for Policy thematic assessment briefs



*Source: TRIMIS*

In the years 2019-2020 several STRIA roadmap assessment reports were published with a focus on a specific STRIA roadmap (for details consult Marques dos Santos, Gkoumas, Tsakalidis, et al., 2021). In 2021, however, the low-emission alternative energy for transport report was updated (Ortega Hortelano et al., 2021; Figure 25), following the relevant update of the Alternative Fuels STRIA roadmap itself.

Figure 25. The low-emission alternative energy for transport assessment report



*Source: TRIMIS*

The report provided a comprehensive analysis of research and innovation in low-emission alternative energy for transport in selected European Union (EU) funded projects with end dates from 2019. Additionally, the report included recent developments in hydrogen, which is covered in the scope of

the updated roadmap on low-emission alternative energy for transport. The reports main results show that *Liquefied Natural Gas refuelling stations*, *Biofuels for road transport* and *Alternative aviation fuels* are among the researched technologies with the highest investments together with research and innovation on hydrogen. The conclusions also highlight that on the way to decarbonisation of transport there is no silver bullet solution and diverse alternative fuels should be further investigated in order to achieve ambitious climate neutrality targets.

## 3.3 Research and innovation in transport and mobility: supporting the green and digital transition

In 2022 in Lisbon was organized the Transport Research Arena – TRA – the largest European transport conference that covers all transport modes and all aspects of mobility. The main theme of the conference was "Moving together – reimagining mobility worldwide". The aim of the conference was to bring together experts from around the world to discuss the newest research and innovations and future of mobility and transport.

On this occasion the TRIMIS team prepared a dedicated Science for Policy brief (Figure 26), titled *Research and innovation in transport and mobility: supporting the green and digital transition* (Marques et al., 2022). The brief offers an overview of relevant research and innovation European projects which are focusing on green and digital transition in transport. The scope and main aim of selected projects is briefly presented. An additional section is dedicated to European partnerships, including Clean Aviation, Towards zero-emission road transport, Zero-emission waterborne transport, Industrial Battery Value Chain, Europe's Rail, SESAR Joint Undertaking, Connected, Cooperative and Automated Driving and Clean Hydrogen. Moreover, a section of the brief includes also a short introduction of the Horizon Europe "100 Climate-neutral and Smart Cities by 2030" Mission.

**Figure 26.** Supporting green and digital transition – Science for Policy Brief



*Source: TRIMIS*

## 3.4 Scientific publications

Together with Science for Policy feedback, TRIMIS team prepared several papers which were submitted and published in scientific journals and conference proceedings. They cover high variety of topics, from papers which are directly based on published Science for Policy reports, topics related to a specific technology (hyperloop, bridge maintenance) up to *Women in transport*. The list of scientific papers published in the years 2021-2022 include:

— Research in bridge maintenance, safety and management: An overview and outlook for Europe (Gkoumas et al., 2021);

— Hyperloop Academic Research: A Systematic Review and a Taxonomy of Issues (Gkoumas, 2021);

— Research and Innovation Supporting the European Sustainable and Smart Mobility Strategy: A Technology Perspective from Recent European Union Projects (Gkoumas et al., 2021);

— The Role of Research and Innovation in Europe for the Decarbonisation of Waterborne Transport (Grosso et al., 2021);

— Women in Transport Research and Innovation: A European Perspective (Hortelano et al., 2021);

— Low-Emission Alternative Energy for Transport in the EU: State of Play of Research and Innovation (Ortega et al., 2021);

— Horizon scanning for transport research and innovation governance: A European perspective (Tsakalidis et al., 2021).

# 4   Conclusions and future works

The presented report offers a comprehensive overview of the latest developments in TRIMIS. The first part of the report summarises the main changes in the TRIMIS database in the years 2021-2022 and provides a detailed description of the status of the research and innovation project database at the end of the Horizon 2020 Framework Programme. The second part is dedicated to the TIRMIS Science for Policy analyses.

The main points related to the enrichment and the status of the **TRIMIS database** are as follows:

⸺ The database contained **over 8,300 research and innovation projects** at the end of 2022. This is a **10% increase** since the previous Status Assessment report prepared at the end of 2020.

⸺ During the period covered by this report, several **data quality improvements** took place. These include the removal of duplicates, updates of project details (e.g. funding, implementation period, etc.), as well as replenishment and correction of TRIMIS tags.

⸺ The majority of **added projects** were funded from 7th and Horizon 2020 Framework Programmes. In total, 55% of projects in the database come from Framework Programmes, mostly from the most recent ones (FP7 and Horizon 2020).

⸺ One-third of the projects are funded from **national sources**. However, during the described period, the focus of TRIMIS was specifically on Framework Programmes, rather than national funding sources. It resulted in relatively low number of added national projects (around 10% of added projects)

⸺ The highest number of projects focuses on **road transport**, followed by the airborne and multimodal transport. Water and rail transport are the least represented in terms of project numbers.

⸺ The ***Vehicle design and manufacturing*** is the thematic area with the highest increase of projects. It also became the area with the highest total number of projects.

During the period covered by this report, TRIMIS published **seven Science for Policy reports**, including:

⸺ three transport mode assessment reports (airborne, rail and waterborne transport);

⸺ three assessment thematic reports (car sharing, public transport and urban mobility and logistics);

⸺ one updated STRIA roadmap assessment report (low-emission alternative energy for transport).

Two of the reports were accompanied by a four-page-long extract of main findings in a form of Science for Policy briefs (public transport and urban mobility and logistics). Moreover, TRIMIS published one dedicated Science for Policy brief for the Transport Research Arena conference (Supporting green and digital transition). Finally, the TRIMIS team published seven scientific publications.

The main **future works related to the TRIMIS database** improvement should be related to:

⸺ addition of projects already awarded from the current Horizon Europe Framework Programme; This activity will be accompanied by the further review of previous Framework Programmes, in particular, no-transport related calls;

— review of other than Framework programmes, including Connecting Europe Facility, Interreg, ESPON, Horizon Europe Partnerships and Joint Undertakings, and European Research Council;

— identification and review of other European project databases, in particular during the preparation of further Science for Policy reports;

— review and update of technology taxonomy;

— review and quality improvement of transport related tags: transport mode, transport sector and thematic area; This also includes replenishment of missing tags;

— update of all CORDIS-based projects in the TRIMIS database.

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## List of abbreviations and definitions

| Abbreviations | Definitions |
| --- | --- |
| ALT | Low-emission alternative energy for transport |
| CAT | Connected and automated transport |
| ELT | Transport electrification |
| FP7 | 7th Framework Programme |
| H2020 | Horizon 2020 Framework Programme |
| Horizon 2020 | Horizon 2020 Framework Programme |
| INF | Transport infrastructure |
| NTM | Network and traffic management |
| PIARC | Permanent International Association of Road Congresses |
| R&I | Research and Innovation |
| SME-1 | Small and Medium Enterprises – phase 1 |
| SMO | Smart mobility and services |
| STRIA | Strategic Transport Research and Innovation Agenda |
| TRIMIS | Transport Research and Innovation Monitoring and Information System |
| TRL | Technology Readiness Level |
| VDM | Vehicle design and manufacturing |

# List of figures

## List of tables

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