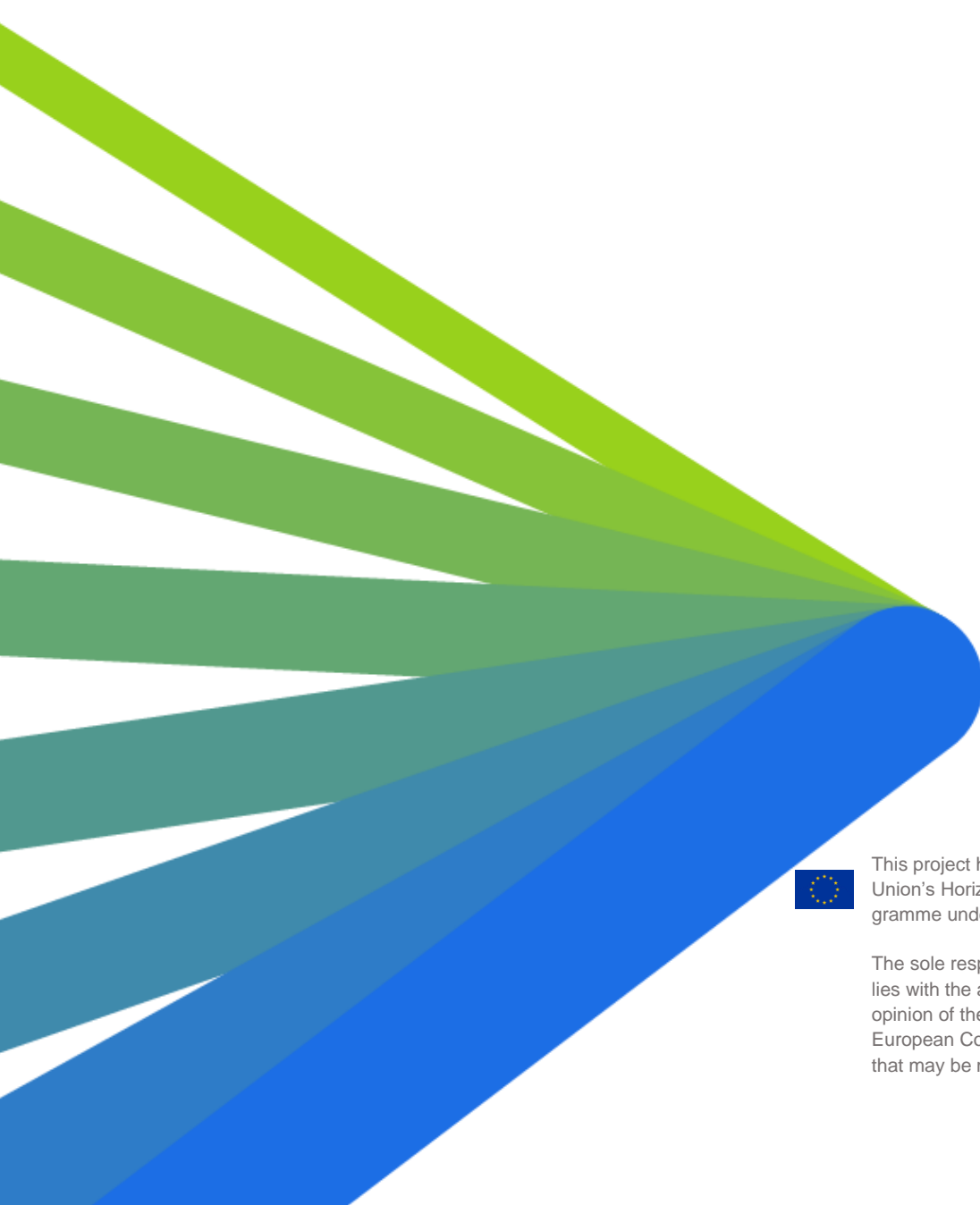




Deliverable D1.2

**Roadmapping methods on European, Member State
and international level**



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Contributor(s)	Luisa Andreone, Vittorio Ravello, Stellantis-CRF Verena Wagenhofer, Peter Prenninger, AVL Zissis Samaras, AUTH Franz Geyer, BMW Thierry Goger, Adewole Adesiyun, FEHRL Peter Urban, RWTH Ivo Cré, Marina Martin Vilches, POLIS Simon Edwards, RICARDO Oliver Lah, Kathleen Dematera Contreras, Vera-Marie Andrieu, UEMI Gereon Meyer, Jakob Michelmann, VDI/VDE-IT Frank Seyfried, Volkswagen
Reviewer(s)	Verena Wagenhofer, AVL, STREnGth_M Coordinator Zissis Samaras, AUTH
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1 Introduction

1.1 Objectives and scope of this report

Designing Road Transport for 2050 is a long-term process that requires collaboration between all stakeholders including public and private sectors. This is one of the goals of the European Technology Platform for Road Transport ERTRAC (R1). Flexibility and adaptability to emerging technologies and societal changes are key to ensuring the success of deployments, however, only proper investments in research and development for existing and emerging transportation technologies can meet societal and economical goals.

Designing Road Transport in Europe for the future involves a wide range of factors, including sustainability, technological advancements, population growth, urbanization, and environment. As an example, to show the complexity of the task of Road Transport R&I roadmapping, a short, and not comprehensive, list of opportunities in the design of Road Transport of the future includes safe and resilient transport, pervasiveness of digitalization, green solutions with electrification and alternative fuels, autonomous and connected vehicles, energy-efficient public transportation systems, Mobility as a Service (MaaS), connected road infrastructure, and harmonized regulations and policies.

This is why leveraging on effective mechanisms for Road Transport R&I roadmapping is essential, and this is the task of the STREnGth_M (R2) project aiming at enhancing current methods and embracing new ones as necessary.

This report is structured to describe the methodology that the STREnGth_M partners defined to perform the analysis on Road Transport R&I roadmapping mechanisms, including a proposed updated definition of what is an R&I roadmap, the details of how the roadmapping activity is performed today, and to report the outcomes of this analysis performed in ERTRAC, at Member States and at international levels. The outcomes of the analysis and the related recommendations are elaborated in the final part of this document.

Why this analysis? To leverage on best practices, lessons learnt and new tools to strengthen the effectiveness of the collaborations in the preparation of the ERTRAC roadmaps on R&I in Road Transport. R&I needs in Road Transport, represented in roadmaps, are an essential tool for the community of stakeholders, to formulate the research needs on a time scale that is related to the technological evolutions and to the related opportunities offered by the ever growing scientific and technological landscape.

Noticeably the roadmaps on R&I needs on Road Transport are one of the instruments for Funding Bodies, at European, Member States and international levels to properly orient the allocation of resources for R&I in Road Transport.

STREnGth_M is a coordination and support action co-funded by the European Commission in the call for project proposals topic: HORIZON-CL5-2022-D5-01-11. The objective of this topic is to promote sustainable Road Transport in Europe and at international level. This action will contribute to a further harmonisation of R&I activities, and therefore contribute to the European Research Area, as well as to the European strategies for future transport systems.

The STREnGth_M project consortium will contribute to the planning of R&I in Europe by identifying future research needs in the field of Road Transport, by updating and supporting the coordination of Strategic Research Agendas and roadmaps in the field and by facilitating continuous exchange between Road Transport research related Horizon Europe partnerships and platforms. It will further analyse research, innovation and cooperation capacities in Member States, explore funding instruments on national and regional level and assess potentials of national and regional roadmaps. This will contribute to strengthen existing and even forge new links between European, national and regional programmes and support structures for international cooperation task forces.

In line with the goal of the STREnGth_M project Work Package 1 entitled “Methods and tools for a collaborative framework” and in particular Task 1.3, the focus of this activity is to assess roadmapping methods at ERTRAC, at Member State and at international levels. Goals of this activity are in line with the project workplan as described hereafter:

Goal of Task 1.3a is to analyse the ERTRAC roadmapping and Working Group mechanisms

Goal of Task 1.3b is to analyse roadmapping mechanisms at European Member State level

Goal of Task 1.3c is to analyse roadmapping mechanisms at international level.

The analysis includes the methods and tools used for recently created roadmaps in order to identify how are the R&I needs included in roadmaps today and how can the process of roadmapping creation be performed in future.

1.2 Connection to European Technology Platforms and/or Horizon Europe Partnerships

As reported in the ERTRAC web site, the STREnGth_M coordination and support action is directly connected to ERTRAC, which is the European Technology Platform for Road Transport recognized and supported by the European Commission.

Preceded by FUTURE-HORIZON (2021-2023) (R3), FUTURE_RADAR (R4), FOSTER-ROAD (2013-2016) (R5), STREnGth_M aims to contribute to the planning of R&I in Europe by:

- Specifying future research needs in Road Transport
- Updating and supporting the coordination of Strategic Research Agendas and roadmaps in the field
- Facilitating continuous exchange between Road Transport research related Horizon Europe partnerships and platforms
- Identifying existing barriers to the deployment of research results at European and international levels
- Measuring the feasibility of innovative solutions for prospective and emerging markets.

1.3 Methodology

STREnGth_M partners started the activity by performing brainstorming sessions to discuss and agree upon the methodology to collect the data to perform the analysis.

The result of this brainstorming activity led to the definition of the methodology defined and adopted by the STREnGth_M partners that is described hereafter. Per each analysis, within ERTRAC, Member States, and international roadmapping, specific questions have been formulated and STREnGth_M partners collected the related replies getting in direct contact with ERTRAC Working Groups leaders and with reference people in charge for Road Transport roadmapping mechanisms in the different ERTRAC Working Groups and Countries in which the analysis has been performed.

The questions about the ERTRAC Roadmapping and Working Groups mechanisms defined in STREnGth_M are as follows:

- 1.a Which are the current interaction modalities among the WG members to prepare the ERTRAC roadmaps? How often and how are the meetings organised?
- 1.b Which are the recommendations for the interaction modalities among WG members to prepare future ERTRAC roadmaps? How are participation and inclusiveness addressed?

- 2.a Which are the current ERTRAC roadmaps creation process, assessment (within ERTRAC and with external stakeholders), supporting SW tools and formats?
- 2.b Which are the recommendations for the ERTRAC roadmaps creation process, assessment, supporting SW tools and format?

- 3.a How is the quality of the ERTRAC roadmaps content and formatting granted?
- 3.b Which are the recommendations for achieving a high quality of the ERTRAC roadmaps content & formatting for the future?

- 4.a What are the present methods for sharing and adopting the ERTRAC roadmaps, their timing and recipients beyond the Working Group members?
- 4.b Which are the recommendations for sharing and up-taking mechanisms (timing and with whom) of the ERTRAC roadmaps outside WG members?

- 5.a How is the outreach of the ERTRAC WG outcomes monitored? (e.g. reflection of the related R&I needs in an EU Work Programme)
- 5.b Which are the recommendations for monitoring the ERTRAC WG outcomes outreach in the future?

- 6.a Which are the current ERTRAC WG leaders and members roles when preparing the ERTRAC roadmaps?
- 6.b Which are the recommendations to ERTRAC WG leaders and members when agreeing on roles to prepare the ERTRAC roadmaps?

- 7. Which are the recommendations related to the ERTRAC roadmaps preparation in an ever-accelerating R&I and technological context?

The questions related to the European Member States and to the International roadmapping mechanisms foresees the replies to questions from 1. to 4. while questions from 5. to 7. are answered when applicable and when related information is available.

These questions have been driving the collection of all data reported in this document, the replies to the questions have been summarized in the following sections of this document.

Road Transport R&I roadmaps and Strategic Research Agendas are worldwide recognised instruments to guide the innovation activities in Road Transport for what concerns the major goals related to climate, safety and smart mobility.

It should be noted that the list of European Member States and other non-EU countries selected for the analysis is not globally representative or exhaustive, but it should be considered as representative examples by tackling countries and regions in which, by the way, the STREnGth_M project partners are well connected and therefore have good access.

Road Transport R&I roadmapping is undertaken worldwide and the extension of the analysis to more countries and regions was out of scope in STREnGth_M, however it is an opportunity for future analyses in follow-up projects.

The outcomes of this activity are at service to the ERTRAC new roadmapping implementation, with specific attention to the hints related to the preparation phases: roadmapping of R&I in Road Transport is a kaleidoscopic activity, its complexity and diversity of the expertise to be involved are real challenges. This is why the new generation of roadmaps shall be given the opportunity to leverage from best practices and recommendations from experts at ERTRAC, at European Member States and at international levels.

2 Roadmapping methods on European, Member State and international level

2.1 Definition of Road Transport Roadmap

Each R&I need is formulated to provide the indication to a framework that contributes to the goals of safety, decarbonization, efficiency, competitiveness of the European transport sector allowing EU targets to be met. Correspondingly, a roadmap indicates what needs to be done to close the gaps and seize the opportunities for Road Transport in Europe.

Accounting for the European Commission Strategic Transport R&I Agenda (STRIA) definitions, and on the basis of the experience in Road Transport roadmapping in ERTRAC, the STREnGth_M proposed European definitions of “roadmap” and “technology roadmap” are as follows:

ROADMAPS in general, have found application in multiple sectors, sometimes cross-sector. Normally, they form a link, a description of a route between a vision, a strategy and the realisation thereof. In the context of European research planning, a roadmap is a detailed plan to guide progress towards a goal and, in the understanding of the European Commission, it aims to inform citizens and stakeholders about the European Commission work, in order to allow them to review, feedback and effectively participate in consultation for specific topics.

TECHNOLOGY ROADMAP also known as a research and technology roadmap, in particular, such as the roadmaps being developed in the ERTRAC context for Road Transport research, is an important reference document, giving such a detailed plan towards a goal: it provides a consolidated single document from the industry and research community, identifying which R&I challenges need to be tackled and which activities need to be harmonised, i.e. when and how complex systems will be developed and deployed.

For the assessment of different roadmapping methods, the project partners have primarily focussed on the ERTRAC definition of technology roadmap. The broader definition of roadmap has been used to assess European Member States and international R&I roadmapping mechanisms as European and international roadmapping typically produces plans to guide progress towards specific goals.

It shall be noted that Road Transport roadmaps are formulated in different ways to respond to the needs of the different stakeholders that are using them, including the R&I Funding Bodies. Examples of Road Transport roadmapping formulations are as follows:

- Strategic R&I Agendas
- Scenarios and R&I Questions
- Descriptive R&I Needs, timelines and related Technology Evolution Roadmaps
- Action Plan.

However, independently from the formulations, each roadmap in Road Transport has not the goal to predict the future, but rather to draw pathways to design the future while meeting the societal goals.

2.2 Road Transport Roadmapping mechanisms

2.2.1 ERTRAC Roadmapping and Working Groups mechanisms

For the analysis of the ERTRAC R&I roadmapping mechanisms, the following ERTRAC Working Groups have been consulted for their recent involvement in roadmaps preparation:

- Urban Mobility
- Long Distance Freight Transport
- Connected Automated Driving
- Road Safety and Security
- Energy & Environment.

ERTRAC Working Group Urban Mobility roadmapping mechanisms

The ERTRAC Urban Mobility Working Group operates in a unique way: this is the only active intermodal and 'inter-purpose' Working Group. The Working Group brings together three technology platforms: ERTRAC, ERRAC and ALICE. In this way, road, rail as well as passenger and goods transport in the urban context are covered. An initial brainstorming of potential contributors is conducted on topics which should be addressed and updated. Initial outreach to gather interest is conducted via email, among WG members, as well as expert from external stakeholders, which includes inquiring if there are further experts which could be recommended to be brought into the process to gather as many stakeholder perspectives as possible. Meetings are generally held online (for the geographical spread of contributors) to initially establish the topics to cover and for volunteers assigning contributors to the individual sections. Contributions are gathered via a collective email thread. Content is consolidated and shared for comments and additional feedback/contributions/reviews. This is repeated as many times as necessary. Bilateral or smaller group online meetings are also conducted as needed.

The creation and assessment process includes outreach and regular updates to members in meetings, as well as multiple opportunities to participate in the process and provide content and feedback. SW tools and format include the exchange of emails, standard formats for documents (Microsoft Word, Excel), and Teams for meetings.

The roadmap is based on an initial assessment of the achievement of the current roadmap. A mapping is conducted of whether research priorities have been addressed since the publication of the roadmap. In parallel, an assessment of existing roadmaps is conducted. R&I roadmaps from ERTRAC Working Groups and from other initiatives such as the Joint Programming Initiative Urban Europe and the Driving Urban Transitions initiative have been analysed. For the current revision of the roadmap the Working Group has established two input papers, namely one on light electric vehicles and one on the 15-minute city. These papers made it possible to go deep diving and elaborating with more details these important topics.

The quality of the content is maintained through experts' contributions and reviews by a coordinator overseeing the process.

Formatting is aligned with the current ERTRAC recommendations and the structure is slightly modified as needed to suit the context, and as recommended through consultations with members and contributors.

ERTRAC members present the roadmaps in networking meetings with public and private stakeholders associations as well as in major Road Transport Conferences at European level.

There is no specific outreach tracking mechanism in place. This is an informal process which is determined through expert communities involved in a wide array of projects, and via partnerships and associations which can determine whether the R&I priorities are being addressed, to continue promoting the recommendations, or to update the information in future materials once the topics are adequately addressed, or are evolving, or are no longer relevant.

ERTRAC Working Group leaders, members, and experts are actively involved in the writing and reviewing process and volunteer to lead and contribute on specific topics of expertise and interest. The process and progress are regularly reported in meetings. The process is open to all interested members and to further stakeholders experts recommended from their networks who engage in the process.

Bringing in experts and stakeholders that represent the perspective of many road users, areas of expertise, and levels of research, is the challenge. Production and operations to identify and address issues, relay the present status and progress, and identify future R&I priorities from the collective information is a challenge as well.

This helps balancing organisational preferences with the wider need to acknowledge issues and research priorities as a collaborative group effort.

ERTRAC Working Group Long Distance Freight Transport roadmapping mechanisms

The ERTRAC Working Group leaders reach out to the Working Group network within ERTRAC and usually start the update process by hosting a first virtual meeting, introducing the activity and topics, calling for volunteers to contribute and to draft. This introductory meeting is usually followed by at least two physical workshops in Brussels in ERTRAC facilities and by several common online meetings, from eight to ten, as well as by some bilateral meetings, also with experts who are not part of the ERTRAC WG.

Up to now, the exchange of text, updates, contents has been done via e-mail, which is practical but makes keeping an overview a bit more challenging than, e.g., using a file sharing platform. For the upcoming update of this roadmap the general document structure is planned to remain the same, since it has proven to be clear and useful to readers. At the end of 2023, a common shared folder has been introduced as a test, but it has so far been challenging to get stakeholders uploading comments on the repository. Up to now the most common exchange tool remains the email exchange.

It is of high importance that the roadmap contents are agreed by the ERTRAC related Working Group community, so it is clear they stand behind the document. This is ensured during the aforementioned meetings or through individual consultations with contributors, organized by the WG leaders.

Using connections in the ERTRAC community and network sometimes ERTRAC WG leaders and/or volunteers reach out to experts and stakeholders outside of ERTRAC to maintain the high quality of the roadmap in elaboration, to gain diverse insights and secure a wider support of the roadmap contents. This can also be beneficial for broadening and deepening the ERTRAC network.

There is no specific procedure to track the outcome of this ERTRAC Working Group roadmap, this is mostly done thanks to experts who are also part of other relevant platforms, partnerships, associations like for example EUCAR (R7), CCAM (R8), CLEPA (R9), ERTICO (R9), EARPA (R10).

The necessity for an update of the roadmap is determined together with the ERTRAC Office. The Working Group leaders and the ERTRAC Office inquire the ERTRAC members who have been included in the Working Group proceedings up to now if the contact persons are still valid or if changes to the mailing list should be made. The WG leaders reaches out to the people on the mailing list and initiates the updates process as described above.

The latest roadmap update was published in 2019, a new update process has been initiated recently in the last quarter of 2023, in parallel to the writing of two short deep diving notes on very specific R&I topics.

ERTRAC Working Group Connected Automated Driving roadmapping mechanisms

Since a number of years the ERTRAC Connected Automated Driving (CAD) Working Group has adopted a robust consultation mechanism that includes: definition of the drafting team, consultation meetings with Working Group members and consultations with stakeholders external to ERTRAC (e.g. CCAM, EUCAR). Meetings are organised either physical or remotely on demand, depending on the ongoing tasks and member and stakeholder participation is always very active and effective.

For inclusiveness of all members, the SW tools and formats are the most commonly used, like for example Microsoft Word, PowerPoint or Excel. The creation and assessment process includes several rounds of consultations with members, typically with voluntary assignments of experts to different specific thematic areas. Consultations include content preparation and assessment, at different phases of the roadmap's preparations.

The drafting team, typically including the Working Group leaders and experts who volunteered on specific thematic, grants the quality of content and formatting with a very strong support from the ERTRAC Office. Consultations are open to all Working Group members and, when published, to the related R&I community as well.

Presentations at specific meetings organised by ERTRAC or by the European Commission or by other related Associations or Conferences in which Working Group leaders and experts are scheduled to share the intermediate and the final versions of the roadmaps.

The outreach is tracked via the analysis of the extent to which the R&I recommendations are inserted into the next Horizon Europe Work Programme and on the analysis of those that are not yet taken into consideration, and will be in the next round, or are becoming obsolete or to be updated.

The ERTRAC Connected and Automated Driving Working Group is already considering valuable inputs from international Road Transport R&I roadmaps. This is possible thanks to the fact that its experts are involved in several international activities, such as in UK and US. Correspondingly the recommendation is to even extend the consultations to international Road Transport R&I roadmaps.

ERTRAC Working Group Road Transport Safety and Security roadmapping mechanisms

The roadmap creation process adopted by the ERTRAC WG Road Transport Safety and Security is described below and was applied amongst others in 2021 for the preparation of the latest Safe Road Transport Research roadmap as well as in 2023 for the preparation of a complementary Road Safety Paper.

Both online meetings and physical meetings in Brussels give room for interaction within the full group of WG members. WG leaders invite to two to three full WG meetings in an overall timeframe of about 9 months for a typical roadmap update. In addition, volunteers who are willing to engage in revising or writing sub-chapters of new roadmap documents have online meetings organised by the WG leaders as needed for coordination. WG leaders communicate on the current status to the full WG and circulate draft versions of new roadmap documents by email.

Assessment and review of draft documents is done in various loops by WG members, as well as by consultation with European Commission representatives in the drafting process. The final approval of new documents is provided by the ERTRAC Plenary, before they are printed and uploaded on the ERTRAC website.

SW support for the activities of the ERTRAC Safety WG is currently provided by common Microsoft Office tools with the roadmap documents written in Word. A number of different online meeting tools are used to organise online meetings.

The quality of roadmap contents is assured by:

- Having the contents based on discussions in a diverse group of experts representing a broad spectrum of different stakeholders
- Having experts involved in the writing of roadmap documents
- Multiple review loops of draft documents by WG members
- Consultation with EC representatives
- Final approval by the ERTRAC Plenary.

The quality of formatting is assured by the use of appropriate templates, thorough formatting work by WG leaders on the documents and a final revision by the ERTRAC Office before the release for printing.

Roadmaps are disseminated to the transport research community, the leaders of the Safety WG also send new documents directly to relevant contact persons at the EC, also as draft versions for consultation. Moreover, WG members are asked to share final roadmaps within their associations and networks.

The reflection of R&I needs from the ERTRAC Safety Research roadmaps in Work Programmes is tracked by the WG leaders and forms an important basis of the updating process of roadmap documents. Related roadmap contents have been very well reflected in EU Work Programmes recently. At the same time road safety and security is a number one priority for ERTRAC, therefore the ERTRAC Safe Road Transport Research roadmap will be further developed consistently and logically in the next years.

ERTRAC Working Group Energy & Environment roadmapping mechanisms

Each leader of the WG takes individual responsibility for leading one or more chapters of the roadmap. One of the WG leaders takes overall responsibility for layout, formatting, consistency checking etc. of the document. ERTRAC staff takes final “publication” responsibility after sign-off by the Board and Plenary.

Typically, there is an open meeting, of ERTRAC Plenary members, where the plans for the roadmap update are presented, discussed and volunteers for various sections are identified.

WG leaders/ERTRAC team organise open kick-off meetings to present planning and to ask for volunteers. Volunteers contribute directly to the roadmap preparation, sending it to the leaders, and editing/developing the contributions in the team meetings of the subchapters. Leaders are responsible for defining the overall storyline.

WG collaboration is done by emails, phone and by regular remote meetings (every week), with the support of a leading team. For the different sections of the roadmap, focused deep diving meetings are also organised, e.g. two-three per week, for a few weeks, to finalise the text for specific individual section.

Beyond the actual WG activities among its members, there are also regular interactions, particularly when the roadmap topics shall be presented to the ERTRAC Board or to the European Commission, with the ERTRAC Director and Chairman, together with EG VIAfor2ZERO. Moreover, when relevant, representatives from EUCAR and CLEPA are invited.

A master of the document is also held on a repository, to which there is leading team access, for final editing, consistency checking etc.

Subsequently, specific topic workshops are arranged (H2ICE and Non-tailpipe emissions for the last edition of the roadmap). With specific speakers, in a conference-like format, where the state of the art is presented, research needs are suggested and discussed, so that further research needs can be formulated, perhaps even specific call for proposals ideas can be formulated.

Documents are prepared with standard Microsoft SW tools to facilitate the working together of all contributors. The activity is done “to best knowledge and belief”. WG members, who contribute with text elements, often ask other experts within their own company to verify or adjust the content. In this WG it is of particular importance to have more than one expert for any topic with high expertise on real-time state of the art as an essential ingredient to be prepared to work together. A circulation of a draft version of the document within ERTRAC and European Commission members adds valuable feedback and content, hence improving the quality.

Once roadmaps are formally approved by ERTRAC Board and Plenary and published on the ERTRAC Website, it would be advisable to track the number of accesses to the published roadmaps. Roadmaps are also printed and distributed at events, where ERTRAC is host or guest and offers a slot with information about all ERTRAC activities to the audience.

About roadmap outreach involvement in meetings when defining Work Programmes, calls etc., such as 2ZERO is performed.

2.2.2 Member States Roadmapping mechanisms

In Austria, Belgium, Germany and Italy, selected for their diverse approaches, the analysis has been performed at the level of Road Transport R&I roadmapping mechanisms. In all other Member States the analysis has been done at the level of the Road Transport R&I roadmapping Entities in charge and is presented in Annex I of this document.

Road Transport R&I Roadmapping Mechanisms in Austria

The Austrian Road Transport roadmapping mechanisms are related to the different associations that are taking care with their initiatives, namely:

A3PS: Austrian Association for Advanced Propulsion Systems

WIVA P&G: HYDROGEN FLAGSHIP REGION, Hydrogen Strategy Austria, R&I Mobility Strategy and ESBS Austria.

Correspondingly, the analysis of the respective mechanisms has been performed per each association.

A3PS is a private, non-governmental association, but initiated by the government to have a special focus on advanced propulsion systems. The association is a platform for industry and academia partners to identify important topics, which are compiled in a multi-annual roadmap and in annual/bi-annual position papers. The contents are shared with government references once a year.

WIVA P&G is a private, non-governmental association for the management of a flagship region funding instrument with a special focus on hydrogen technologies. The association is a platform for industry and academia to identify important topics, which are compiled in a multi-annual roadmap.

The Hydrogen Strategy Austria is an initiative driven by the Austrian government. Members of the hydrogen strategy advisory group make non-binding suggestions and give recommendations. The final prioritization is done based on political strategy.

ESBS Austria is a private, non-governmental association which collects topics in the field of electronics and software-based systems.

The R&I Mobility Strategy is an initiative driven by the Austrian government. A steering group consisting of BMK, FFG, AIT and Austria Tech holds regular stakeholder meetings to identify important topics for the mobility strategy and vision.

A3PS: the identification and prioritization are done by the association. The selection of call topics by the government is based on the A3PS roadmap and on the political strategy.

WIVA P&G: the identification and prioritization are done by the association. The confirmation of the call topics by the government is based on the political strategy.

Hydrogen Strategy Austria: the identification of topics is done by the association members (i.e. industry, academia, public institutions). The final prioritization and preparation are done by the government.

ESBS Austria: the ESBS position paper introduces the R&I needs gathered from Austrian members.

R&I Mobility Strategy: workshops with experts of already existing groups and/or platforms (such as Rail System, National ALICE mirror group, Mobility laboratories advisory group, Vehicle Technologies - A3PS, Future of transport infrastructure, Automated Mobility; ITS Austria platform, Austrian Rail Industry Association) are organized. The roadmap, strategy, vision paper is prepared by the steering group.

The other EU and/or Member States Roadmaps that are consulted are as follows:

- A3PS: ERTRAC, EARPA, EUCAR, CLEPA
- WIVA P&G: Hydrogen Europe
- Hydrogen Strategy Austria: Other Member States' roadmaps
- ESBS Austria: ECS SRIA
- R&I Mobility Strategy: EC documents, such as the European Green Deal, Europe on the Move, Strategic Transport R&I Agenda (STRIA).

Austrian roadmaps are connected to National funding mechanisms as follows:

- A3PS: a selection of call topics for special, technology oriented national funding instruments is partly based on A3PS roadmaps and position papers
- WIVA P&G: a selection of call topics by the association members is based on the multi-annual workplan and confirmed by the government
- ESBS Austria: the selection of focus topics out of the previously proposed focused topics from the ECS SRIA is done with dedicated budgets
- R&I Mobility Strategy: it is the basis for national funding calls on mobility topics
- Hydrogen Strategy Austria: not directly connected. There is no dedicated major funding programme for hydrogen topics.

The current engaging mechanisms and interaction modalities among the stakeholders involved to prepare the roadmaps are as follows:

A3PS: the cooperation of members and the elaboration of roadmaps and position papers is done in four Working Groups - hybrids & sustainable fuels; electrification and BEV; hydrogen and FCV; advanced vehicle concepts. On average they meet four times a year, but the frequency is driven by demand.

WIVA P&G: the cooperation of members takes place in a dedicated Working Group called Research Strategy. There are quarterly meetings and a few special meetings for the elaboration of the research roadmap.

Hydrogen Strategy Austria: this is an isolated initiative/action and there are not regular updates and no continuous exchange of members.

ESBS Austria: there are regular biannual meetings with additional working meetings on demand. The meetings are open to all association members.

R&I Mobility Strategy: the R&I Advisory Council meets from two to three times per year.

The current Roadmaps creation process, assessment, are:

A3PS: the general roadmap is updated every three to five years. The position papers of the Working Groups including short- and mid-term research requirements are updated every one to two years.

WIVA P&G: the roadmap is updated every two to three years. Special tools or formats are not used.

Hydrogen Strategy Austria: this is a single action with no regular updates planned.

ESBS Austria: usually the position paper is updated once a year.

The quality of the roadmaps content & formatting is granted as described hereafter:

A3PS: the leaders of the Working Groups are responsible for checking the contents and the quality control. The formatting is done by the central office of the association.

WIVA P&G: the leaders of the Working Groups are responsible for checking the contents and the quality control. The formatting is done by the central office of the association.

Hydrogen Strategy Austria: this is done by the government / ministries.

ESBS Austria: the ESBS Austria office manages quality and formatting of the position papers.

The current sharing and uptake mechanisms are:

A3PS: the roadmap and position papers are presented to government representatives and the finalized roadmaps are published on the association webpage, where they are free to be downloaded. Printouts of the roadmaps and position papers are also handed out the annual A3PS conference.

WIVA P&G: the roadmaps are published on the association webpage, where they are free to be downloaded. Lobbying for the roadmap is done at the annual conference of the flagship regions.

Hydrogen Strategy Austria: the publication is done by the government/the ministries via their internet platform only.

ESBS Austria: The documents are published online and at press-conferences.

R&I Mobility Strategy: The publication is done by the government / ministries via their internet platform.

The outreach of the roadmaps is tracked in A3PS with the download frequency checked on the A3PS webpage and with the A3PS topics identified in national call texts. While for the R&I Mobility Strategy, the steering group monitors the call and the project results to further refine the strategy.

Road Transport R&I Roadmapping Mechanisms in Belgium

Belgium, like many other countries, may employ various mechanisms for Road Transport research and innovation (R&I) roadmapping. These mechanisms help define and prioritize R&I activities in the field of Road Transport. Here are some common approaches and mechanisms that are used in Belgium:

Government Initiatives: government agencies, at both federal and regional levels, can launch initiatives to create Road Transport R&I roadmaps. These initiatives often involve collaboration with industry stakeholders, research institutions, and experts to identify research priorities and strategic directions.

Research Programs: public funding agencies, such as the Belgian Science Policy Office (BEL-SPO) and regional funding organizations, may provide funding for research programs focused on Road Transport R&I. These programs often include a strategic vision and research priorities. Most competences in view of R&I have been devolved to the regional level. The Flemish FWO (Fonds Wetenschappelijk Onderzoek / Research Foundation), the Brussels Regional 'Raad voor Wetenschapsbeleid van het Brussels Hoofdstedelijk Gewest' and the Walloon Regional Wallonie Recherche SPW.

Stakeholder Engagement: stakeholder engagement processes, including workshops, consultations, and working groups, can be used to gather inputs from various stakeholders in the Road Transport sector. These inputs are valuable for shaping R&I roadmaps.

R&I Clusters: Belgium has R&I clusters that bring together industry, academia, and government to collaborate on R&I initiatives. These clusters often develop strategic roadmaps for specific sectors, including Road Transport. Specifically Flanders Make can be mentioned in this regard. This structure brings together three clusters of which one 'Motion Products' integrated the former Flanders Drive automotive cluster. Five Key research institutes provide specific support: KU LEUVEN, VUB, U Antwerpen, U Gent and UHasselt. Flanders Make as a network of innovators establishes five years roadmaps in coordination with the region. The roadmap is drafted by the chief scientific officers and validated with members and institutions mentioned above.

Another experience that is worth mentioning is the approach IMEC is taking with its internal roadmapping. IMEC is the world-leading R&D and innovation hub in digital & nanoelectronics technologies. A substantial part of its activities is dedicated to smart cities and transportation. The institute establishes three to five years roadmaps based on issues raised by stakeholders and future scenario development (with 10-15 years timescales).

Collaboration with the European Union: Belgium, as an EU member state, collaborates with the European Commission and participates in EU-funded R&I programs related to Road Transport. These programs often have defined roadmapping processes.

Academic Research: universities and research institutions in Belgium conduct academic research in Road Transport and may contribute to roadmapping road mapping mechanisms by identifying research needs and opportunities.

Industry Associations: industry associations like FEBIAC (Belgian Federation of the Automotive and Cycling Industry) may be involved in developing Road Transport R&I roadmaps, particularly in collaboration with government authorities.

Public-Private Partnerships (PPPs): PPPs can be established to foster collaboration between government, industry, and research organizations in defining the R&I priorities and roadmaps.

Road Transport R&I Roadmapping Mechanisms in Germany

In general, German roadmap activities initiated by the government have been topic-specific and based on consultations with the industry, scientific and other stakeholders. There is no singular, repetitive governed roadmap process by the federal government across all domains of the Road Transport sector.

The agenda of the coalition agreement of the government and coherent strategies determine the areas for upcoming R&D programmes. For instance, the recently updated “Strategy for the future for R&I” (formerly the “High-Tech Strategy”) formulated by the Federal Ministry of Education and Research defines milestones and priorities in six topical missions to work towards certain SDGs and competition related innovation areas. The strategy was not co-created with particular stakeholder-groups to harmonise actions. Though, it considers evaluations on topics and modalities to work on these topics, e.g. by the Expert Commission R&I (formed by a committee of academics) and knowledge gathered by the ministry units through exchange with their stakeholders and coordinators of previous research projects. The final draft strategy has run through a consultation process enabling civil society, industries and academia to react through written feedback. Although the strategy names challenges and goals for the automotive mobility among others, the strategy does not ascribe times to the goals and the technology path to be taken by the industry and academia. Concluding, this strategy is not a technology roadmap.

Albeit, no continuous Road Transport roadmapping process owned by the government or by ministries has been established, topic-specific initiatives are formed implementing roadmapping activities for some automotive topics from the coalition agreement or the previous national R&I strategies.

If new urgent or promising topics occur on the horizon, the parliament and government can add new R&I topics to the political agenda any time. The horizon scanning or trend monitoring is not institutionalised for the automotive sector in one institution. Ministries seek the information via various channels. However, expert boards, associations and initiatives from academia and industry overtake these roles and inform ministries on new developments, challenges and needs for automotive R&I, e.g. through whitepapers and industrial roadmaps for example by the German Association of the Automotive Industry (VDA), the Association of German Engineers (VDI) and the eNOVA Strategy Board on Automotive Future.

There is no particular centralised process in Germany to gather and process the R&I needs from stakeholders. However, the federal ministries have contracted innovation and programming agencies like PT-DLR, PTJ and VDI/VDE-IT with R&I strategy development and evaluation tasks that serve this purpose. Occasionally, there are time-bound topic-specific platforms and mechanisms in place for this purpose.

One comprehensive initiative was the National Platform Electric Mobility (NPE) co-led by five ministries to bring together all necessary resources to plan and deploy electric mobility in Germany from 2009 to 2020. The platform was the first and only attempt for a national public private partnership for R&I in general at federal level. The platform consisted of OEMs, suppliers, academics, civil associations and representatives of ministries. They were organised in four Working Groups. The fifth Working Group functioned as an interface to elaborate a synchronized roadmap.

The platform drew a roadmap until 2020 showing milestones, fields of action and quantitative targets for the deployment by 2020. More roadmaps have been produced, e.g. on Power-to-X since the platform got a new commission by the previous government (2017-2021). It was renamed National Platform Future of Mobility. The analysis shows that the current government does not seem to pursue the development of joint Road Transport roadmaps, since the platform's commission has not been renewed. The government instead introduced an expert board on the transformation of the automotive sector led by the Federal Ministry of Economic Affairs and Climate Action and one on climate protection in mobility led by the Federal Ministry for Digital and Transport. Several experts and stakeholder consultation formats were and will be conducted to formulate white papers. These conclude on fields of action to develop competitive automotive products for the future and suggest positive policy framework conditions. Both boards will present and discuss their findings in a mutual exchange with the steering committee chaired by the Federal Chancellery.

In preparation of these roadmaps invited experts active in various boards or initiatives such as ERTRAC, or the SRIAs of partnerships like 2ZERO and CCAM bring in their knowledge on European R&I needs. Moreover, federal ministries are active in the state representative groups of the partnerships. As part of the H2020 programme committee for transport of the European Commission, the German federal government was following the Strategic Transport R&I Agenda (STRIA).

The roadmaps of the National Platform Electric mobility were not translated 1:1 into funding programmes. However, many topics found their way into funding programmes. The ministries responsible for funding research topics have their own directing power to allocate budgets and assign units with the elaboration of programmes related to particular R&I needs.

How the topics are selected, is decided by the departments and related innovation and programme agencies. Usually, the decision for a programme is based on its scientific and industrial urgency or meaning for the future.

In the example of the current expert boards on the transformation of the automotive industry and on climate protection in mobility, the Working Groups incorporate academic and association representatives. They work closely together with the respective ministry. They meet biannually or quarterly. The boards consult the industry and other stakeholders occasionally. The consultation processes give other initiatives, OEMs, suppliers, SMEs and industry associations the opportunity to present parts of their roadmaps.

In the example of the National Platform Electric Mobility industry, academic and policy representatives took part in the working groups.

The creation processes are usually moderated by a secretary office of the platform or board. Usually R&I agencies or consultancies take these roles.

The processes range from bottom-up surveys to very structured approaches. There is no software tool known that supports the creation other than editorial design software.

The quality is secured by internal and partially external validation. Usually, wider stakeholder groups were invited to validate the roadmap in the context of specific conferences of the national platforms.

The validation of the whitepapers produced by the expert board on the transformation of the automotive industry and the expert board on climate protection in mobility is assumed to happen internally through the involved academic representatives.

Usually, conferences and media discuss and cover the results of such processes. For instance, the results of the roadmap process of the National Platform Electric Mobility were discussed on the federal conferences on electric mobility in 2013, 2015 and 2016.

There is no general mechanism for tracking roadmaps outreach. This is usually topic specific. For the roadmap on electric mobility, the outcome was tracked through an accompanying research and evaluation project on R&I and demonstrators. Further, the community outside the roadmap process discussed the developments at conferences.

Road Transport R&I Roadmapping Mechanisms in Italy

In Italy the reference Association for Road Transport R&I roadmapping is Cluster Trasporti Italia. Cluster Trasporti Italia is an association representing thirty-three industries, fifteen university centres, eight research organizations, thirteen public-private aggregations (which include over 2,000 partners), six trade associations, and six Italian regions. The Association is part of the National Technology Clusters (CTN) having been recognized (December 2012) by the Ministry of University and Research (MUR) as the interlocutor, grouping together the land and maritime mobility transport stakeholders. The CTN actors are supporting the ministry itself for the realization of the National Research Program (PNR) and of the national position towards the new EU programs. In particular, in relation to the Structural Funds and Horizon Europe. Cluster Trasporti Italia is organised in the following thematic:

ROAD TRANSPORT for the development of sustainable powertrains, safe and integrated mobility systems and new more efficient and less energy-intensive manufacturing processes are the key themes engaged by technological and industrial players.

RAIL TRANSPORT for efficient regional and urban transport means, promotion of intermodal transport and strengthening of networks for the construction of rail corridors capable of connecting the nerve centres of the European market: these are the challenges for the railway sector.

SEA TRANSPORT for passenger and merchant ships, yachts as well as commercial and leisure ports: Italy has for years occupied a position of strong relevance for these assets, the maintenance of which in conditions of increasing international competition, requires constant technological improvement of products and processes.

ITS (Intelligent Transport System) contributing to the transversal development of mobility. Integrated applications of telecommunications, electronics and information technologies, to improve the management and control of transport systems.

For the definition of the R&I needs on Road Transport Italy relies on the Cluster Trasporti Italia activities since its foundation in 2014. Cluster Trasporti Italia prepares and periodically updates its Action Plan (latest edition is 2021-2027). The Action Plan includes so-called “R&I trajectories” with related “R&I lines” and synthetic descriptive actions. Since its foundation, Cluster Trasporti Italia has followed an experts-based approach in selecting and prioritising the R&I to prepare the related roadmaps. Cluster Trasporti Italia performs periodic consultations with its partners’ experts, guided by champions, and revises the definition and the prioritisation of the R&I trajectories with the whole community of its experts.

Cluster Trasporti Italia defined and periodically updates its Road Transport R&I missions, in line with the European Horizon Europe R&I missions. The R&I needs, formulated as R&I trajectories, are formulated, selected and prioritized around the missions. The stakeholders involved are partners of the Association: Road Transport industries, research institutes, trade associations and Italian regions. Cluster Trasporti Italia assigns the preparation of the R&I roadmaps to its Scientific Board which directly manages the Working Group leaders, one per each of its thematic areas.

Working Group leaders work in orchestration among them for a harmonized team working among the Groups and with Working Group members experts on the different R&I technical contents.

For its roadmapping activities, Cluster Trasporti Italia mainly refers to the European Road Transport missions and Strategic Research Agendas. The Cluster Trasporti Italia Action Plan 2021-2027 (or Strategic Research Agenda in its previous editions) is one of the reference documents the Italian Ministry of University and Research (MUR) is using for the realization of the National Research Programs.

Today Cluster Trasporti Italia is adopting an agile working mechanism in the interaction modalities among the Stakeholders involved in the preparation of the roadmaps, with meetings periodically organized on demand either in remote or in presence modalities. Roadmapping meetings periodicity is continuously adapted to the requirements related to the delivery of the Action Plan updates. This mechanism did evolve in its decade of history: it started with a fixed structure of meetings organization and moved towards the adoption of an agile framework of cooperation. The fixed structure of meetings approach has been very useful particularly in the ramp up phase of the Cluster Trasporti Italia, while the agile approach is the most efficient in the roll out phases and is facilitated by the intensification of remote meetings in the last years.

The creation process is constantly followed with the guidance of the Governing Board of Cluster Trasporti Italia whose members act as senior mentors in the process. The assessment of the contents preparation is in the hands of the experts involved in the different fields, who follow the guidelines of the Working Groups leaders. The supporting SW tools are selected to be as inclusive as feasible to enable all members to easily contribute without barriers, this is the reason why common tools for documents (Word), data (Excel), presentation (PowerPoint) are selected as well as shared working areas with easy access are made available to members working in the different Working Groups.

The quality of the Action Plan contents and formatting is granted by detailed revisions firstly performed by the Working Group leaders.

The approval of the Action Plan is performed, in series, by the Scientific Board, by the CISG (Committee for Strategic Planning and Management of the Association), and by the General Assembly of the Association. The sharing and uptake mechanisms are typically events in which other Italian stakeholders, external to the Cluster Trasporti Italia, are invited for consultations, as well as the Ministry of University and Research. Events timing is tailored around roadmapping new editions delivery, typically every 1-2 years. The roadmaps have been acquired by a number of ministries of the Italian Government, namely, the Ministry of Sustainable Infrastructure and Mobility, the Ministry of Environment and Energy Safety, the Ministry of the Enterprises and Made in Italy. The outreach of the Cluster Trasporti Italia, from the viewpoint of its roadmapping, is easily tracked by its Governing Board (CISG), Scientific Board and Working Group leaders by a periodic checking of which R&I trajectories have been included in National Work Programmes. Additionally, regional Clusters or organizations (CIM4.0 from Piedmont, CLM from Lombardy, MareFVG from Friuli Venezia Giulia, Distretto Ferroviario from Tuscany, Innovazione Automotive from Abruzzo, Dattilo from Campania) are in contact with relevant stakeholders in a quadruple-helix framework. Continuous contacts are active with regional administration offices, research organizations, industrial associations and general public.

2.2.3 International Roadmapping mechanisms

Road Transport R&I Roadmapping Mechanisms in UK

The UK government has an automotive roadmap that outlines joint government and industry commitments to achieve the decarbonisation of Road Transport. See <https://www.gov.uk/government/publications> Automotive Roadmap. These are generally documents intended for public consumption and are of an informative, political nature. The information below relates specifically to the generation of the “technology roadmaps” for the automotive R&I activities within the UK.

The first UK Automotive consensus roadmap was published in 2009. A number of additional roadmaps were added over the next few years based on the output from the Auto Council R&D group and a consolidated group of roadmaps was published in 2013. The technology work group identified five workstreams, each of which encompassed a number of roadmaps:

- Internal combustion engines
- Energy storage and energy management
- Intelligent Mobility
- Lightweight vehicle and powertrain structures
- Electric machines and power electronics.

All roadmaps have a shelf life so the roadmaps are regularly updated. Since 2013, responsibility for updating and adding/refining topics associated with propulsion has been with the Advanced Propulsion Centre. These were originally published in 2018 with an update in 2021 and another update is underway at present.

The APC has a specific Technology Trends team that in collaboration with the Automotive Council, organises consultations with all of the UK Automotive stakeholders to both define which technology areas are priorities and to also arrange workshops with UK topic specialists to create or update roadmaps as required.

Whilst connected & automated technologies, lightweighting and digitalisation topics were originally covered by the Auto Council, these have also now been adopted by the APC with specific funds allocated to support late stage R&I in these areas.

In the UK, public funding to support R&I is arranged by different organisations depending on the TRL. Low TRL (1-3) is funded via the Engineering and Physical Sciences Research Council (EPSRC) at UK Universities. Industrial research (TRL 4-6) is led by UK R&I (UKRI) whilst late stage (TRL5-8) Automotive R&D is supported by the UK Advanced Propulsion Centre (APC), including capital support for facilities and/or scale up.

All of these organisations use the roadmaps as an input to thematic calls but with less emphasis at low TRL and greater influence at higher TRL's. All of these organisations have close links; EPSRC and UKRI operate under the same umbrella organisation, whilst the APC has the relevant UKRI lead as a board member and also organizes and consults with an academic advisory group. The APC facilitates workshops, collates information and prepares the relevant documentation but approval is obtained from workshop stakeholders before publication.

The APC uses all available and relevant roadmaps as part of the consultation/workshop process. As such, roadmaps from several other nations or supra-national regions are consulted by the contributors when inputting into the process. The most relevant are those produced by the ERTRAC working groups and the broader, higher level roadmaps on transport, manufacturing and materials produced by UKRI. However, most of these are more generic and, whilst useful for developing or refining the roadmap process and future requirements/targets, the UK often has the most up to date and specific roadmaps for automotive topics, particularly those associated with propulsion, connected/automated driving and digitalisation.

The Automotive roadmaps in the UK do not produce R&I priorities themselves. They define the most logical or likely technologies that will need to be developed and implemented to achieve a specific target or outcome. R&I priorities or themes will be defined by the grant funding R&I organisations such as UKRI or the APC and will use the roadmaps as a key part of their process in defining calls for proposals.

The UK Automotive Roadmap process is led by the Advanced Propulsion Centre but in close collaboration with members of the Automotive Council. The Automotive Council knows the contributors to previous roadmaps: whichever NGO is allotted to undertake the update of the roadmap, e.g. the APC, those previous contributors are contacted and asked to contribute again and/or recommend further contacts. The NGO then goes through the process of contacting the contributors, getting via the survey, an identification of the possible areas for update of the roadmap.

Workshop attendance is voluntary and open to all stakeholders who are specialists in the roadmap topic. Open invitations will be posted by the APC to all who express an interest in making a contribution. Workshops are held, whenever possible, as physical meetings but often in a hybrid mode using virtual workshop and whiteboard tools.

The workshops, usually 2-3 hours, are repeated as necessary, e.g. four times. Analysis of the workshop output and preparation of the roadmaps and related documentation is made by the APC Technical Trends team and then circulated to workshop attendees for correction/approval, often with a follow-up meeting.

The roadmaps all follow a specific format to easily identify them as UK APC/Auto Council documents. The roadmaps then enable common challenges to be identified by the Technical Trends team who will again summarise, circulate and gain approval from workshop attendees. All roadmaps and priorities are ultimately approved by the UK Auto Council via the specific working group that covers the roadmap topic and then by the main council once this has been obtained.

Workshop content is recorded either via the traditional whiteboard and post-it notes (on chevron diagrams) or using a similar virtual process such as Miro. Although specific roadmap software with interactive output was initially trialled for some roadmaps, this proved to be ineffective for communication.

The whole purpose of the Auto Council/APC roadmaps are to clearly and concisely communicate to all stakeholders, including policymakers and non-specialists, where the focus for new technologies should be to meet a particular technical or societal goal. The roadmap documents make it clear that they are consensus views and do not necessarily represent any specific plan by any of the contributors.

Quality assurance is achieved through a consistent facilitation, preparation and approval process. The roadmaps use a consistent graphical format and limited to a self-explanatory single page or slide for each roadmap topic. This summary is supported by an explanatory text describing the rationale or context for those who are looking for more detail. This will also include the implications arising from the roadmap such as the common research challenges or future UK investment needs.

Following approval, the roadmaps are launched via a webinar with open access and the associated documents are published on the APC website. The APC monitors access or traffic viewing the roadmaps and reports this on a regular basis.

Reference to the associated roadmap is encouraged for those seeking public funding support for a particular topic area. Whilst assessment of proposals for public funding support for Automotive R&I is carried out by independent agencies in the UK, such as UKRI and the APC, final approval and sign-off is with the associated Government department that provide the funding: the Department for Business and Trade for APC; the Department for Science and Innovation & Technology for UKRI & EPSRC.

Road Transport R&I Roadmapping Mechanisms in USA

The United States has a well-established system for Road Transport R&I, involving various government agencies, academic institutions, and private sector organizations. While the landscape of R&I is continually evolving, here are some key mechanisms and initiatives related to Road Transport R&I in the USA:

Federal Highway Administration (FHWA): FHWA is a branch of the U.S. Department of Transportation (USDOT) responsible for the development and maintenance of the national highway system. It funds and conducts research programs related to road infrastructure and safety.

National Cooperative Highway Research Program (NCHRP): NCHRP is a USDOT-sponsored research program that focuses on applied research in highway transportation. It addresses various Road Transport issues, including safety, design, and innovation.

Transportation Research Board (TRB): TRB, part of the National Academies of Sciences, Engineering, and Medicine, is a major forum for researchers and professionals in the transportation field. It facilitates research collaboration and knowledge sharing.

Intelligent Transportation Systems (ITS): the U.S. actively invests in ITS, which includes technology-driven solutions for Road Transport, such as traffic management, connected vehicles, and autonomous driving.

Advanced Transportation Technologies: the U.S. government and private sector are engaged in research on advanced transportation technologies, including electric and autonomous vehicles.

University Research Centres: numerous universities across the country have transportation research centres dedicated to studying various aspects of Road Transport, from traffic management to sustainability.

Partnerships with Industry: government agencies often collaborate with private sector companies to foster innovation in Road Transport, including the development of intelligent infrastructure and smart road technologies.

Highway and Infrastructure Projects: the U.S. regularly undertakes large-scale highway and infrastructure projects, incorporating innovation in design, materials, and construction methods.

Safety Initiatives: the National Highway Traffic Safety Administration (NHTSA) and other organizations are actively engaged in research aimed at improving road safety, reducing accidents, and implementing innovative safety technologies.

Alternative Fuels and Sustainability: research into alternative fuels, sustainable road construction materials, and environmentally friendly transportation practices are ongoing.

Public-Private Partnerships (PPPs): PPPs are utilized for major transportation projects, with private sector entities contributing to financing and implementing innovative solutions.

Smart Cities Initiatives: several U.S. cities are implementing smart city initiatives that involve technology and innovation in transportation systems and infrastructure.

Freight and Logistics Innovation: the U.S. is a global leader in freight and logistics, and research is ongoing in areas like supply chain optimization and innovative transportation methods.

Federal Funding Programs: the U.S. government allocates funding for R&I in Road Transport through various programs, including the Transportation Investment Generating Economic Recovery (TIGER) program and the Infrastructure Investment and Jobs Act (IIJA).

International Collaboration: the U.S. collaborates with international organizations, research institutions, and countries to access global best practices and stay updated on innovations in Road Transport.

U.S. is known for its dynamic and innovative transportation sector, making it a significant area for Road Transport R&I.

U.S. federal modal transportation agencies (including the Federal Highway Administration, Federal Transit Administration, and others) develop an Annual Modal Research Plan as prescribed by law. Approved plans are located at <https://www.transportation.gov/administrations/assistant-secretary-research-and-technology/rdt-annual-modal-research-plans>.

The plans indicate how priority research and technology areas contribute to national goals and objectives over a two-year budget period.

U.S. federal modal transportation agencies work closely with stakeholder organizations representing U.S. state and local transportation agencies (such as the American Association of State Highway Transportation Officials, the American Public Transportation Association, etc.), industry, and designated Federal Advisory Committees (such as the U.S. DOT Advisory Committee on Transportation Equity). Roadmaps are associated with focused areas of research and technology and may result from initiatives by government, industry, or non governmental organizations, as seen for example reflecting the diversity of funding and stakeholders involved in highway transportation research in the U.S.

The Federal Highway Administration (FHWA) conducts international benchmarking, which can provide a foundation for a new research roadmap or updating an existing research roadmap. Example areas of study are available at <https://international.fhwa.dot.gov/programs/mrp/gbp.cfm>. FHWA also monitors international research and technology developments through its involvement in international organizations such as PIARC.

There are no direct connections to the National funding mechanisms, however it is important to mention that the thematic identified are considered as one of the references for the National funding mechanisms.

Road Transport R&I Roadmapping Entities in charge in Brazil

Brazil is actively involved in Road Transport R&I to improve its transportation infrastructure and address specific challenges in the sector. Here are some key mechanisms and initiatives related to Road Transport R&I in Brazil:

Ministry of Infrastructure (Ministério da Infraestrutura): the Brazilian Ministry of Infrastructure plays a central role in the development and regulation of Road Transport in the country. It often releases guidelines and funding opportunities for R&I projects related to road infrastructure and technology.

National Transport Plan (Plano Nacional de Transportes): Brazil periodically develops national transport plans that include Road Transport infrastructure and innovation. These plans provide a roadmap for the development and enhancement of the transportation network.

Instituto de Pesquisas Rodoviárias (IPR): the Road Research Institute (IPR) in Brazil is responsible for conducting research and development in road engineering and technology. It is actively involved in research projects related to road infrastructure and safety.

Collaboration with Academic Institutions: government agencies in Brazil often collaborate with universities and research institutions to conduct research on various aspects of Road Transport, including safety, sustainability, and technology.

Transport Infrastructure Concessions: Brazil has implemented infrastructure concessions in which private sector companies are involved in the development, maintenance, and management of road infrastructure. This often involves innovation in construction and operation.

Road Safety Initiatives: Brazil has been working to improve road safety, including research into safety technologies, road design, and education campaigns.

BRT and Public Transportation Projects: Brazil has implemented Bus Rapid Transit (BRT) systems and public transportation projects that involve road infrastructure and transportation technology innovation.

Biofuels and Sustainable Transportation: given Brazil's focus on renewable energy sources, there has been research into biofuels and sustainable transportation methods, including the use of ethanol in vehicles.

International Collaboration: Brazil collaborates with various international organizations and research institutions to access global best practices and stay updated on innovations in Road Transport.

Logistics and Trade Initiatives: Brazil's role as a major exporter and its extensive road network necessitate ongoing R&I in logistics and transportation.

Brazil has a diverse and evolving transportation landscape, and staying informed about the latest developments is a relevant reference.

Road Transport R&I Roadmapping Mechanisms in China

Noticeably the landscape of R&I in China is continually evolving, and new initiatives may emerge any time. Some notable mechanisms and initiatives include:

China 2035 Transportation roadmap: this is a high-level government initiative aimed at developing a comprehensive transportation plan for the country. It includes Road Transport as a key component and sets the direction for innovation and research in the sector.

Ministry of Transport (MOT): the MOT in China plays a significant role in promoting R&I in Road Transport. They often release guidelines and funding opportunities for projects related to road infrastructure and technology.

National Key Research and Development Program: this program, organized by the Chinese government, funds research and development efforts in various sectors, including transportation. It has supported research projects related to Road Transport innovation.

Collaboration with Academic Institutions: Chinese government agencies and the private sector often collaborate with universities and research institutions to conduct research on Road Transport. This can include projects related to smart transportation, electric vehicles, and road safety.

New Energy Vehicle (NEV) Initiatives: China has been actively promoting the development of new energy vehicles, including electric cars and hybrid vehicles. This initiative involves substantial R&I efforts in the automotive and Road Transport sector.

Smart City Development: many Chinese cities are actively developing smart transportation systems, which involve innovative solutions for Road Transport. These projects often include the integration of technology for traffic management, public transportation, and road safety.

Belt and Road Initiative: China's Belt and Road Initiative has led to significant infrastructure development, including Road Transportation networks in participating countries. R&I plays a crucial role in designing and implementing these projects.

Innovation Hubs and Clusters: China has established innovation hubs and clusters in various regions to foster research and development in technology and transportation. For instance, cities like Shenzhen and Hangzhou have become prominent technology hubs with a focus on transportation innovation.

International Collaboration: China collaborates with various international organizations, including the United Nations and the International Transport Forum, to share best practices and stay updated on global innovations in Road Transport.

With specific regards to China's roadmapping mechanisms related to Road Transport research and development, authors of this document have identified as one reference the following public report:

IGCC REPORT China's roadmap to Becoming a Science, Technology, and Innovation Great Power in the 2020s and Beyond: Assessing its Medium- and Long-Term Strategies and Plans. Authors: Tai Ming Cheung, Barry Naughton, and Eric Hagt, ed. July 2022.

In this report, and specifically in the paragraph: the Status of the 2021-2035 Medium- and Long-Term (MLP) Science and Technology Development Plan, essential ingredients can be derived to respond to the questions defined by the STREnGth_M methodology for the analysis of the Road Transport roadmapping mechanisms. Correspondingly, the following text is an excerpt of the aforementioned report.

In China, preparatory work to support the drafting of the 2021-2035 MLP formally commenced in the fall of 2018.

At the end of August 2018, the Chinese Academy of Sciences established eight specialized committees to examine key areas covering the MLP. On September 5, the central government

launched its MLP planning efforts when the National Leading Group on Science & Technology System Reform and Innovation System Construction convened its first meeting.

Chaired by Vice-Premier Liu He, a report by the Ministry of Science and Technology (MOST) on proposals for the MLP was discussed and a decision was made that state agencies should “urgently study the preparatory work related to the development of the MLP”. On September 14, MOST held a seminar on “Research on the Thinking of the MLP” that marked the official start of the MLP drafting process.

Numerous meetings and conferences were convened in subsequent months to ensure that the drafting of the MLP would be completed by the end of 2020 so it would be ready for adoption. On October 11, 2018, the National Science and Technology Management Systems Party Building Work Exchange Forum was held. At the National Science and Technology Work Conference on January 9, 2019, Wang listed the preparation of the MLP as one of the top ten most important annual S&T tasks for the country.

The formal drafting process for the MLP officially began on June 24, 2019 with the launch meeting of the 2021-2035 Medium- and Long-Term S&T Development Plan. Xu Qiong, Director of the Strategic Planning Division of MOST, introduced the background, key tasks, and strategic research selection of the plan. On July 12, MOST held a symposium with foreign experts to listen to their suggestions on China’s future S&T development.

A major week-long planning seminar under the auspices of the administrative office of the leading group responsible for the formulation of the MLP was held in July 2019. The seminar covered more than 30 major research topics and thousands of experts participated in the event. In late September 2019, the Department of Strategic Planning at MOST released the “Research Catalogue of Major Issues in the MLP” and solicited public input. In November 2019, MOST selected 21 work units to conduct 20 research tasks in 15 research directions.

In January 2020, the annual National Science and Technology Work Conference was held and the preparation and release of the MLP was listed among the top ten annual tasks of MOST. But with the outbreak and massive political, economic, and social upheavals caused by COVID-19 from January 2020 onwards, this led to significant disruption to the MLP drafting process, reflected in a sharp downturn in news reporting about MLP related activities. There was little reporting about major MLP meetings and events until June 2020 when Wang Zhigang hosted a symposium on national medium- and long-term S&T development planning for veteran S&T workers.

At the meeting, invited experts had the opportunity to provide their opinions and suggestions on the new MLP. Following the 5th Plenum at the end of October 2020, Wang Zhigang chaired a MOST party group meeting and stressed the need to strengthen the S&T planning system and continue with the urgent preparations of the MLP and 14th Five Year Plan (FYP) for S&T Innovation. This review of the numerous meetings, seminars, workshops, and other events between 2018 and 2020 offers a general overview of the different stages in the MLP formulation process. The initial launch phase to mobilize the scores of institutions and thousands of scientists, engineers, and bureaucrats to work on the MLP occurred from September 2018 to February 2019.

This was followed by the Strategic Research phase from March to December 2019, which then turned into the text drafting, demonstration support, and approval phase between October 2019 to the end of 2020.

MLP Research Topics: the coverage of topics investigated for possible inclusion in the MLP was wide-ranging.

The Economic Information Daily reported that an inter-agency leading group had been formed to oversee the preparatory research that was led by MOST with participation from 27 ministries, state commissions, and the State Council General Office. At the start of the MLP preparatory process, a wide net was cast across 50 strategic research directions. This was subsequently reduced to 30 key topics that were sorted into seven major sections of the intended plan. These topics included, among others, information technology and network security, complex service computing and AI, energy research, advanced manufacturing, material science, space technology, urbanization and urban development.

The Strategic Planning Department at MOST issued a 2021-2035 MLP Major Topics Research Catalogue in September 2019 that solicited bids for 20 research tasks to universities and think tanks. Many of the research topics put forward addressed policy and social science issues rather than technical issues.

A number of special MLP study groups were also established to organize and conduct research in key areas. A selection of these groups covers basic science, investment and management mechanisms for S&T funds, agricultural development, public security, intellectual property and technical standards development, cross frontier and disruptive innovation research, and industrial synthetic biology.

Media coverage of MLP related issues by mainland-based news organizations began to gain momentum in the first quarter of 2019 with more than 1,100 articles published. News coverage peaked in the second quarter of 2020 with more than 4,000 MLP related news articles, with also considerable media attention in the fourth quarter of 2020 with more than 3,300 news items.

Road Transport R&I Roadmapping Entities in charge in India

India is actively involved in Road Transport R&I to address its transportation challenges and promote sustainable and efficient mobility. Some of the key mechanisms and initiatives related to Road Transport R&I in India include:

NITI Aayog (National Institution for Transforming India): NITI Aayog is the premier policy think-tank of the Government of India, providing both directional and policy inputs. NITI Aayog was formed in 2015, replacing the Planning Commission instituted in 1950 in order to better serve the needs and aspirations of the people of India. The Governing Council of NITI Aayog, comprising Chief Ministers of all the States and Union Territories with legislatures and Lt Governors of other Union Territories, is the premier body tasked with evolving a shared vision of national priorities and strategies, with the active involvement of States, in shaping the development narrative. The Governing Council of NITI Aayog presents a platform to discuss inter- sectoral, inter-departmental and federal issues to accelerate the implementation of the national development agenda.

So far, seven meetings of the Governing Council have been held under the chairmanship of the Hon'ble Prime Minister with Chief Ministers/Lt Governors of the States/UTs and other members of the Governing Council. The outcome of these meetings are summarized on the website of the NITI Aayog.

Ministry of Road Transport and Highways (MoRTH): MoRTH plays a central role in the development and regulation of Road Transport in India. It often releases guidelines and funding opportunities for R&I projects, including projects related to road safety, infrastructure, and technology.

Department of Transport (state-level): each state in India has its own Department of Transport, complementing the role of the central Ministry of Road Transport and Highways (MoRTH). Each state's Department of Transport is responsible for implementing transportation infrastructure decisions within its jurisdiction, based on the needs and context of the state.

National Highway Authority of India (NHAI): NHAI is responsible for the development, maintenance, and management of national highways in India. They are involved in various research initiatives to enhance the quality and efficiency of road infrastructure.

Indian Road Congress (IRC): IRC is a professional body of highway engineers in India, and it plays a vital role in developing Road Transport standards, guidelines, and research publications. They often collaborate with government agencies on research projects.

National Automotive Testing and R&D Infrastructure Project (NATRIP): NATRIP is a significant initiative aimed at promoting automotive research and testing infrastructure in India, which includes aspects related to Road Transport innovation.

Technology Innovation for Inclusive Growth (TIIG): TIIG is a government program aimed at fostering innovation and research in various sectors, including transportation. It supports projects that aim to develop innovative solutions for Road Transport challenges.

Smart Cities Mission: the Indian government's Smart Cities Mission includes transportation as a critical component. Many Indian cities are actively working on smart transportation solutions, including innovations in Road Transport, traffic management, and public transportation systems.

Electric Mobility Initiatives: India is working on promoting electric mobility and electric vehicles (EVs). R&I are crucial in this space, with programs and incentives to support EVs technology development and adoption.

Collaboration with Academic and Research Institutions: Government agencies often collaborate with universities and research institutions to conduct research in various aspects of Road Transport, including safety, sustainability, and technology.

Start-up and Innovation Hubs: India has seen the emergence of numerous start-ups and innovation hubs focusing on transportation technology and road safety solutions. These start-ups often receive support from government initiatives and private sector investors.

International Collaboration: India collaborates with international organizations, such as the World Bank and the United Nations, to access global best practices and stay updated on innovations in Road Transport.

National Logistics Portal (NLP): the NLP aims to provide a single-window platform for logistics related information and services. It involves technology and innovation in logistics and transportation.

Roadmapping in India is a strategic and collaborative process, involving key stakeholders at both national and state levels. The NITI Aayog plays a significant role in this process by convening meetings of the Governing Council, which includes representatives from union territories, states, and the government, as well as liaisons with the automobile industry. These meetings facilitate discussions on national priorities and strategies, shaping the development narrative for Road Transport in India.

In addition to the central efforts, modifications and updates to the roadmap are often communicated via press releases by India's Press Information Bureau. This ensures transparency and public awareness about the ongoing developments in the sector. Furthermore, each state's Department of Transport makes local decisions, thereby tailoring solutions to the needs and contexts of their states.

Road Transport R&I Roadmapping Entities in charge in Japan

Japan is a country that places a strong emphasis on R&I, and this extends to Road Transport as well. Here are some key mechanisms and initiatives related to Road Transport R&I in Japan:

Ministry of Land, Infrastructure, Transport and Tourism (MLIT): MLIT is the primary government agency responsible for the development and management of transportation infrastructure, including Road Transport. It often releases guidelines and funding opportunities for R&I projects.

Japan Road Association (JRA): JRA is a public corporation that conducts research and development on road infrastructure, traffic safety, and related topics. It is actively involved in Road Transport R&I.

Public-Private Collaborations: Japan often fosters public-private collaborations to support R&I in the Road Transport sector. These collaborations bring together government agencies, academic institutions, and private sector companies.

Innovative Transport Systems Research Program (ITSRP): ITSRP is a government initiative aimed at promoting R&I in transport systems, which includes Road Transport. It supports projects focused on enhancing transportation efficiency and safety.

Smart Transportation Initiatives: Japan is actively working on smart transportation systems, involving the integration of technology for traffic management, public transportation, and road safety.

Electric Vehicle (EV) Initiatives: Japan is one of the leaders in electric mobility and EV technology. R&I in the EV sector, including battery technology, charging infrastructure, and EV manufacturing, are significantly addressed in R&I.

Highway and Bridge Innovation: Japan has been known for its innovative highway and bridge construction methods and materials. Research in this area is seen as crucial for developing efficient and sustainable road infrastructure.

Collaboration with Academic and Research Institutions: government agencies often collaborate with universities and research institutions to conduct research in various aspects of Road Transport, including safety, sustainability, and technology.

International Collaboration: Japan collaborates with various international organizations, research institutions, and countries to access global best practices and stay updated on innovations in Road Transport.

Transport and Technology Hubs: Japan has established technology hubs and research centres that encourage innovation in transportation, including Road Transport.

Zero Emission Vehicle (ZEV) Roadmap: Japan has a roadmap for the development and adoption of zero-emission vehicles, which includes electric vehicles and fuel cell vehicles. This initiative involves extensive R&I efforts.

Highway and Transportation Research Institutes: Japan has institutions and organizations dedicated to transportation research, such as the National Institute for Land and Infrastructure Management and the National Institute for Environmental Studies.

Japan is known for its advanced transportation technology and a strong commitment to research, objectively making it a technology relevant area for innovation in Road Transport.

Road Transport R&I Roadmapping Mechanisms in the Philippines

The roadmapping process in the Philippines is a coordinated effort involving several key national agencies. The organization of R&I needs around prioritized thematic is a systematic process that arises from detailed roadmapping activities within each sector. The stakeholders involved are selected based on their specific expertise and alignment with the sector in question. Apart from the national government agencies, the stakeholders typically include the industry (e.g., body builders, manufacturers, assemblers, and industry associations such as the Electric Vehicle Association of the Philippines, and the Chamber of Automotive Manufacturers of the Philippines, Inc.), the academia and subject experts. The finalized roadmaps are made publicly accessible and are disseminated through the relevant government agency's website; however, the mechanisms for tracking their outreach and influence on policy and funding decisions are not explicitly laid out.

The Department of Science and Technology (DOST) formulates policies and projects in the fields of science and technology in support of national development.

The DOST operates three internal planning councils that prepare the roadmaps or elaborate the thematic areas. The Philippine Council for Industry, Energy, and Emerging Technology Research and Development (PCIEERD) is responsible for Road Transport. This council oversees 29 sectors, including transport. This agency is responsible for uploading the finalized and approved roadmaps to their website.

Meanwhile, the Department of Trade and Industry (DTI) is responsible for fostering a globally competitive, innovative industry and services sector that contributes to inclusive growth and employment generation. DTI develops roadmaps for industries to provide clear direction, foster growth, and encourage innovation. These strategic plans outline current state, future goals, and steps necessary for industry advancement, promoting collaboration among stakeholders like government, businesses, and academia. The development of industry roadmaps is aligned with the priority industries identified by the DTI within its industrial policy. These roadmaps strategically focus on sectors identified as crucial for national economic growth and development, and industrial transformation. These industries for development are outlined in the Philippine Development Plan. The country's trade, investments, and industrial policy are all focusing on the development of these priority industries.

Unlike other government agencies' macro-level roadmaps, DTI's are industry-level roadmaps which are more targeted, aiming to enhance competitiveness, innovation, and growth within specific sectors crucial to the economy. These roadmaps delve into the nuances, challenges, and opportunities within a particular industry, detailing a vision for its development, growth, and competitiveness over a defined period. Beyond R&D, industry roadmaps encompass a broader spectrum, including market trends, infrastructure needs, regulatory factors, workforce development, and technological advancements.

The National Economic and Development Agency (NEDA), on the other hand, is involved in the formulation of the aforementioned Philippine Development Plan and the roadmap for Transport Infrastructure Development. NEDA's key functions extends to R&D and roadmap development. One of the key initiatives where NEDA's involvement is clear is the Harmonized National R&D Agenda for 2017-2022, covering the agenda of various areas of research including Industry, Energy and Emerging Technology.

NEDA also formulates ten-year plans, prompting the DOST-PCIEERD to consult other government agency plans. NEDA conducts meetings involving several national government agencies for them to present their priorities. For instance, if the Department of Transportation prioritizes public utility vehicle modernization, the DOST aligns its efforts accordingly.

Key government departments, including the DTI's Bureau of Product Standards, the Department of Transportation, and the PCIEERD, play integral roles in this process.

While no specific international roadmaps are routinely consulted, the process is nonetheless informed by a variety of international references. International conferences attended by national government agencies also inform the DOST's alignment of its roadmaps/thematic areas based on global outcomes. These references are determined by the national sectoral agencies involved in the roadmap preparation. Ad-hoc international studies and feasibility studies from other organizations would also be utilized. Industry-level roadmaps often align with international frameworks like the UN Sustainable Development Goals (SDGs).

As for engagement beyond the national government agencies, one of the engagement mechanisms is the Technical Committee 89 (TC89) on Electric Vehicles (EVs). This multi-stakeholder committee reviews standards and prepares roadmaps regarding which standards to prioritize for EVs. Representatives from DOST actively participate in these TC89 meetings. In addition, DOST also consults with industry associations such as the Electric Vehicle Association of the Philippines.

Beyond this, the national government maintains close ties with non-government subject matter experts who have participated in international forums. Organizations such as the Transportation Science Society of the Philippines (TSSP), which brings together experts across various fields of transportation, also play a role.

For DTI, the creation of a roadmap can span approximately six months, contingent on the complexity and scope of the industry in question. This typically involves around six consultation sessions, conducted through either physical or virtual focus group discussions. Since industry roadmaps are industry-driven, the participation of the industry permeates every aspect of the roadmap development, from conceptualizing the vision and gathering industry information, to defining the objectives and targets.

The Philippine roadmaps are linked to national funding mechanisms. This connection is primarily facilitated through DOST-PCIEERD. The PCIEERD regularly issues calls for proposals inviting researchers, organizations, and startups to submit project proposals that correspond with the roadmap's focus areas. In doing so, they establish a direct link between international initiatives and national funding mechanisms.

Various infrastructure projects under these roadmaps are financed through multiple sources including the government budget, Official Development Assistance (ODA), and private sector contributions. The Department of Trade and Industry (DTI) also frequently submits recommendations derived from industry-specific roadmaps to the (DBM) Department of Budget and Management for funding evaluation. These proposals outline strategic initiatives, infrastructure needs, skill development programs, and other critical investments essential for the growth and competitiveness of specific industries.

Approved roadmaps are made publicly accessible by the DOST-PCIEERD through their website, on their dedicated 'Road Maps' page: <https://pcieerd.dost.gov.ph/library/road-maps>. DOST-PCIEERD also maintains a presence on various social media platforms. The industry roadmaps developed by the DTI are also typically accessible to the public.

The quality of roadmaps in the Philippines is assured through a process of annual updates and reviews to ensure they align with the current requirements, goals, and budgetary allocations. Key industry figures and government champions also hold a critical role in the continuous review and monitoring of these industry roadmaps to ensure they remain relevant in dynamic market conditions and technological advancements. Also, DTI maintains an open line of communication and collaboration with industries as a core practice. This ongoing engagement involves active dialogue, information exchange, and partnership building between the DTI and various industry stakeholders.

The tracking of the outreach of roadmaps in the Philippines follows a process that is not fully specified, as it involves various government departments and agencies.

The Department of Budget and Management (DBM) is the primary funding source for many national agencies, including the DOST. Similarly, the DOST's National Research Council of the Philippines (NRCP) funds research and minor feasibility studies.

The Philippine Sustainable Finance Roadmap, for instance, provides a tool allowing the government and other stakeholders to track and monitor climate expenditures at various levels, including municipalities. This indicates a level of integration and tracking of roadmap goals.

Road Transport R&I Roadmapping Mechanisms in South Korea

South Korea strategically selects R&I thematic for roadmaps by considering the country's specific needs and global trends. For the Road Transport sector, the Ministry of Land, Infrastructure and Transport primarily prepares these thematic roadmaps, with the Korea Transportation Research Institute handling the operative tasks.

Ministry of Land, Infrastructure and Transport (MOLIT) is the central authority of the Republic of Korea responsible for the affairs concerning land, infrastructure and transport.

Korea Transportation Research Institute (KOTI) is an official governmental research agency of the Republic of Korea. The mission of KOTI is to provide recommendations and alternatives for the nation's transport policy and to create the optimal transport system through specialized research and technical innovations, while positioning itself as one of the world leading transport research institutions.

The Prime Minister's Office directs carbon neutrality and green growth plans, executed by the National Institute of Green Technology. Roadmap development is a public-inclusive process, with updates handled by the respective government department. These roadmaps are informed by global practices and reports, and incorporate R&I needs through multi-sectoral consultations.

National Institute of Green Technology (NIGT) is a government-funded think-tank that coordinates and supports national green technology R&D policies in collaboration with Korean ministries and agencies. The NIGT serves as Korea's gateway for global green technology cooperation, as it connects developed and developing countries for the growth and diffusion of green technology and strategies. The NIGT is partnered with UNDP, UNESCAP, UNIDO and World Bank, and its mission is to lead green technology innovation and create a new growth engine for the developing countries in the world.

South Korea selects and prioritises R&I thematic for roadmaps by considering the country's specific needs and global trends. The Ministry of Land, Infrastructure and Transport predominantly prepares South Korea's R&I thematic roadmaps for the Road Transport sector, with the operative work being handled by the Korea Transportation Research Institute.

Various ministries and research institutions also contribute to this process by gathering diverse opinions from industry, academia, and research institutes. An example of this is the 2030 Basic Plan for Sustainable Transportation and Logistics Development, which aims to reduce South Korea's greenhouse gas emissions by 24.3% by 2030. This Basic Plan was prepared based on research conducted by the Korea Transport Institute (May 2020 - July 2021) through overseas case studies, analysis of future conditions, and advisory meetings with experts in the transportation and logistics sector.

Organising the R&I needs around the prioritised thematic involves a committee of experts from industry, academia, and research institutes. They gather diverse opinions for the road-map preparation.

For reference, a basic plan for carbon neutrality and green growth is planned at a higher level, in which the Prime Minister's Office supervises the planning process.

The National Institute of Green Technology (NIGT) was specifically tasked with the implementation of the 3rd carbon neutrality and green growth plan. Each detailed task within these plans is managed by different government ministries. It's important to note that this plan is interconnected with the 2030 Basic Plan for Sustainable Transportation & Logistics Development, indicating a coordinated approach to sustainability and environmental goals.

For instance, the Ministry of Trade, Industry and Energy is responsible for eco-friendly car production plans, while the Ministry of Environment manages the distribution and charging infrastructure for such cars. Other key stakeholders include the Ministry of Trade, Industry and Energy (MOTIE), the Ministry of Science and ICT (MSIT), and the Ministry of Environment (MOE). These entities collaborate to prepare the roadmaps.

In developing these roadmaps, South Korea primarily draws upon the experiences of key global players, namely the USA, Europe, China, and Japan. Additionally, South Korea utilizes reports from renowned international organizations such as the OECD and IEA.

The South Korean roadmaps are connected to National funding mechanisms. Following a government plan has been confirmed, several key agencies collaborate with the government to strategize funding programs for each priority area. These agencies include:

- Korea Automobile Testing & Research Institute (KAIA), operating under the Ministry of Land, Infrastructure and Transport
- Korea Institute for Advancement of Technology (KIAT), under the Ministry of Trade, Industry and Energy
- National Research Foundation of Korea (NRF), under the Ministry of Science and Technology
- Korea Environment Industry & Technology Institute (KEITI), under the Ministry of Environment.

The engaging mechanisms among the stakeholders involved in preparing the roadmaps include public hearings and meetings where diverse opinions are collected. However, the frequency and format of these meetings are not mentioned or defined explicitly.

The government publishes information about public hearings on their websites, such as with regard to the 2030 Basic Plan for Sustainable Transportation and Logistics Development, formulated to reduce greenhouse gas emissions of South Korea by 24.3% by 2030. The call of an online public hearing (online due to the pandemic) in July 2021 from KO-TI's conference room has been uploaded to the website of MOLIT. Public hearings are broadcast live on YouTube (i.e. by searching for "Korea Transport Institute" on YouTube and watching the live broadcast) and can be participated in through the KOTI website.

Any interested citizen, during the process, can check the contents of the plan and present opinions through the MOLIT website (<http://www.molit.go.kr>). The current roadmap creation process involves collecting diverse opinions, holding public hearings, and making modifications to the original draft based on the collected feedback. No specific supporting SW tools or formats are mentioned.

The quality of the roadmaps content and formatting is ensured through a process of public hearings and modifications based on feedback received. This iterative process ensures that the final version of the roadmap is well-curated and relevant.

The sharing and uptake mechanisms of the roadmaps outside the stakeholders involved in the preparation are not explicitly mentioned. However, once a roadmap is created, the government holds a public hearing to collect various opinions.

When it comes to updating, while certain government plans have a legally mandated update cycle (for instance, the energy plan which is revised every five years), it appears that some roadmaps, like the 2030 Basic Plan for Sustainable Transportation and Logistics Development, does not follow such a fixed schedule. The frequency of updates may be determined on a case-by-case basis. The responsible entity for these updates, however, would be the ministry responsible for the roadmap.

The tracking of the outreach and dissemination of the roadmaps primarily happens internally within the government department that established the plan. This department reports on progress and major results annually, and these reports often serve as key performance indicators for the department's activities.

The reflection and implementation of R&I needs are integrated into programming through consultation processes involving government ministries, government-funded research institutes, and funding agencies. Upon confirmation of the government plan, various agencies collaborate with the government to plan funding programs for each major area.

Key funding agencies include the Korea Automobile Testing & Research Institute (under the Ministry of Land, Infrastructure and Transport), the Korea Institute for Advancement of Technology (under the Ministry of Trade, Industry and Energy), the National Research Foundation of Korea (under the Ministry of Science and Technology), and the Korea Environment Industry & Technology Institute (under the Ministry of Environment). Experts from relevant fields often participate as committee members in the government plan writing process, funding program planning process, and project review process.

Road Transport R&I Roadmapping Entities in charge in the UAE

The United Arab Emirates (UAE) is actively involved in Road Transport R&I to improve its transportation infrastructure and services. Here are some key mechanisms and initiatives related to Road Transport R&I in the UAE:

Ministry of Infrastructure Development: the Ministry of Infrastructure Development in the UAE is responsible for the development of infrastructure, including road networks. It is involved in planning, funding, and overseeing R&I in Road Transport.

Transport R&I Program (TRIP): TRIP is a government initiative aimed at fostering R&I in the transport sector, which includes Road Transport. It supports projects focused on improving transportation infrastructure, safety, and efficiency.

Transport Authorities: different emirates within the UAE, such as the Roads and Transport Authority (RTA) in Dubai, have their own agencies responsible for Road Transport. These authorities are involved in R&I to address the specific needs of their regions.

Infrastructure Projects: the UAE is known for its ambitious infrastructure projects, including the construction of modern road networks, bridges, and tunnels. R&I are integral to the planning and execution of these projects.

Smart City Initiatives: Many cities in the UAE, including Dubai and Abu Dhabi, are working on smart city initiatives. These initiatives involve the integration of technology for intelligent traffic management and the development of innovative Road Transport solutions.

Public-Private Partnerships (PPPs): the UAE has been open to PPPs in the transportation sector. These partnerships often involve private companies that bring innovation into road infrastructure development and management.

Electric Vehicle (EV) Initiatives: the UAE has shown interest in electric mobility and EV adoption. R&I in the EV sector, including charging infrastructure and EV technologies, are part of the transportation landscape.

Logistics and Trade Initiatives: given the UAE's role as a global trade and logistics hub, R&I in Road Transport are crucial to improve the efficiency of logistics operations.

Transport and Innovation Hubs: the UAE has established innovation hubs and free zones that encourage R&I in various sectors, including transportation.

The UAE is known for its dynamic and rapidly evolving approach to infrastructure and technology. To obtain the most up-to-date and detailed information about Road Transport R&I roadmapping mechanisms in the UAE, government sources, industry publications, and academic research in the field are available on the related websites.

International Collaboration: the UAE collaborates with various international organizations, such as the International Road Transport Union (IRU) and the World Bank, to access global best practices and stay updated on innovations in Road Transport.

3 Results, findings and outlook

In general, preparing Road Transport R&I roadmaps requires a systematic and collaborative approach. Experts in R&I on Road Transport worldwide have already established very effective frameworks for the preparation of Road Transport R&I roadmaps, whose main characteristics can be summarised in the steps listed hereafter. Noticeably, on a case-by-case basis, based on the national or international context and on the roadmap target audience, experts working on Road Transport R&I roadmapping can adopt the most suitable path through these steps grouped in three main phases as shown in Fig. 1.

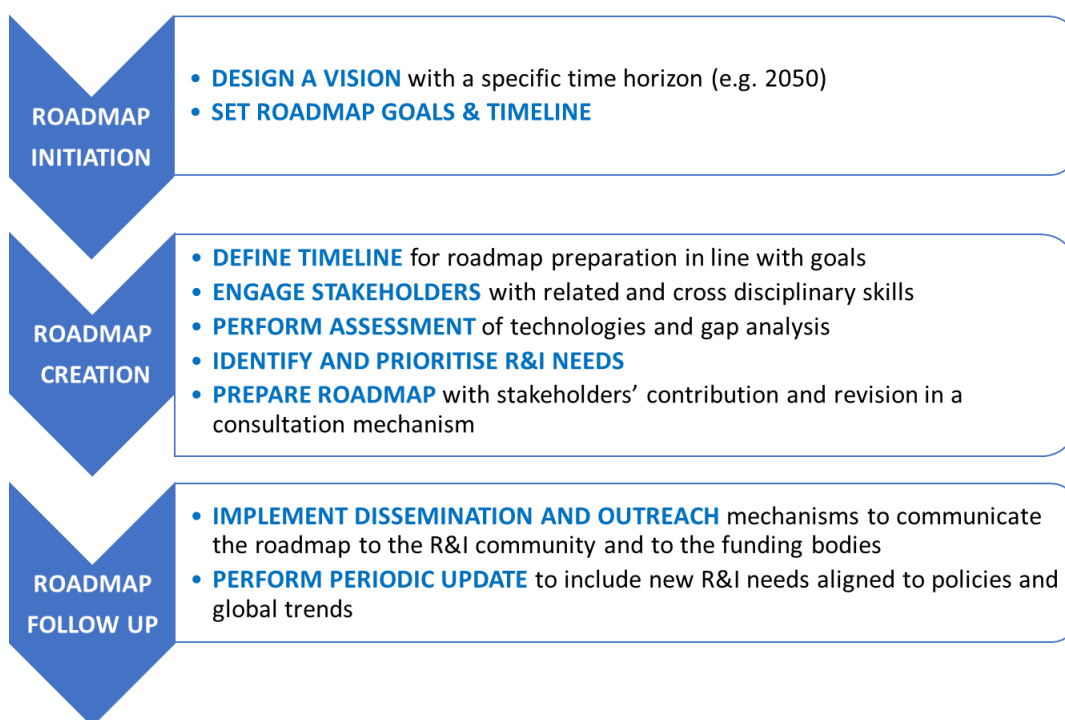


Fig. 1 R&I roadmaps preparation phases and main related actions

PHASE 1 - Roadmap Initiation, preparatory actions

- Definition of the vision and Goal setting: defining a clear vision and specific common goals for the roadmap, taking into account long-term objectives for the Road Transport sector. In ERTRAC this phase may involve a stakeholder team cross Working Groups as it is the case when setting the ERTRAC Vision 2050.

PHASE 2 - Roadmap Creation

- Setting a clear timeline for the roadmap preparation: in ERTRAC the timeline for roadmap preparation is set in line with the proposed timeline for the take up of the R&I needs by the European Commission.

- **Stakeholder Engagement:** involving a wide range of stakeholders, including government agencies, industry and technology experts, researchers, and society, to ensure diverse perspectives and expertise. The need for commitment to the roadmap demands to be as inclusive as possible with the different stakeholders, the more the stakeholders will see their goals to be in line with common goals the more they will get engaged in the deployment. In ERTRAC this is granted thanks to its members that are actively contributing into the different ERTRAC Working Groups.
- **Technology Assessment:** conducting thorough technology assessments to understand current state of the art and emerging technologies relevant to Road Transport.
- **Gap Analysis:** identifying the technological and deployment gaps and challenges in the Road Transport sector that need to be addressed through R&I.
- **Horizon Scanning:** keeping track of global trends and developments in Road Transport, including technological advancements, policy changes, regulations and societal demands.
- **Prioritization:** prioritizing R&I areas based on their potential socio-economic impact, deployment feasibility, and alignment with the roadmap's goals.
- **Roadmap preparation:** developing a clear roadmap with a clear structure, specific milestones, timelines, and action items for each prioritized R&I area.
- **Cross-Disciplinary Collaboration:** promoting collaboration among different disciplines, such as transportation engineering, environmental science, information technology, and social sciences, to address complex and cross-cutting challenges.

PHASE 3 – Roadmap Follow Up

- **Dissemination and Outreach:** raising awareness about the roadmap and its objectives among the public and stakeholders through conferences, workshops, and information via different dissemination materials.
- **Monitoring and Evaluation:** implementing a robust monitoring and evaluation framework, based on the “Plan, Do, Check, Act” cycle methodology, to track the progress of roadmap implementation, assess the impact of R&I projects, and make necessary adjustments.
- **Funding Mechanisms:** identifying potential funding sources, including government grants, private sector investments, and international collaboration opportunities, to support R&I activities, ultimately increasing their impact on economy and society.
- **International Cooperation:** collaborating with other countries and international organizations to leverage global knowledge and resources, especially for addressing shared Road Transport challenges.
- **Policy Alignment:** ensuring an effective networking between public and private stakeholders so that the roadmap aligns with existing and upcoming policies and regulations, and advocate for necessary policy changes when needed.

- Adaptive Management: being prepared to adapt the roadmap as new information and challenges arise, ensuring its relevance and effectiveness over time.
- Data and Analytics: using data analytics and modelling tools to inform decision makers and identify trends and areas of improvement within the Road Transport sector.
- Societal, Economic, Environments Impacts analysis: considering social, economic, environmental implications of Road Transport innovations, to foster responsible and sustainable development.

Creating effective Road Transport R&I roadmaps is an ongoing process that requires continuous collaboration of a diverse stakeholder network towards a common goal, feedback, exchange, and adaptation to address the evolving societal, environmental and economic needs and challenges for future mobility solutions.

The ERTRAC Working Groups and the ERTRAC Governing Board are working on a continuous check and update of the roadmapping mechanisms to keep pace with the ever-accelerating R&I and technological context.

The analysis performed in this document highlights that diversity, with respect to a general approach, is one of the keys of success, as it allows to contextualise the roadmapping mechanisms to the specific R&I Road Transport field, the related country and regional policies and related funding mechanisms.

In this document ERTRAC experts proposed an updated definition of ROADMAPS and TECHNOLOGY ROADMAPS with the aim to disambiguate the different related tasks when dealing with roadmapping in ERTRAC in Europe. Moreover, the ERTRAC Working Group leaders analysed the current ERTRAC roadmapping mechanisms and proposed recommendations that are summarised hereafter.

In general, the current roadmapping mechanisms at ERTRAC have proved to be very effective so far. This is reflected in the uptake of the R&I topics identified by the roadmaps as inputs to the forthcoming Horizon Europe Work Programmes.

From the more strategical viewpoint, ERTRAC plans for the roadmaps and initial concepts are always presented to members in regular meetings and openly discussed, which allows for the opportunity to gather people's interest to contribute. This is repeated as each roadmapping process continues and various stakeholders representing different perspectives are welcomed into the process. Participation and determination of who would initially submit text for individual topics/sections is working well through online and physical meetings with everyone interested involved to gather volunteers and contributors. Additionally, a good mix of physical and virtual meetings revealed to be a very effective way of co-working with experts.

From the more operational viewpoint, ERTRAC Working Group leaders make sure that Working Group members have a good understanding of what is expected from them when volunteering for roles in the active preparation of roadmap chapters.

In addition, the respective time schedule is set to be realistic and clear to everyone involved from the beginning, including the necessary review and revision loops.

ERTRAC members volunteering for an active role are requested to be aware of the time that they will need to invest as part of the drafting team or as contributors.

Since the current interaction modalities in the ERTRAC Working Groups have developed and grown over time and have been very effective and inclusive, it is recommended to continue with the methods described in this report.

The dissemination of ERTRAC roadmaps to national stakeholders and funding bodies is effective, however it could be intensified for example creating specific excerpts or modular documents, with respect to current roadmapping, to be used for different dissemination purposes.

The online availability of the ERTRAC roadmaps is a key element of dissemination, and this is already in place. However, hand out of printed versions, maybe in the form of excerpts, is also recommended when it comes to dissemination in Road Transport international events. A further step could also be to create a newsletter to “followers”.

A recommendation from ERTRAC Working Group leaders is to involve more than one expert per each technical topic, this is viable as ERTRAC experts can extend the network of consultation to their company / association / academia experts on the specific topic.

A further recommendation from ERTRAC Working Group leaders would be to adopt a shared workspace that allows all members to actively work on the same document. However, the diversity of the restrictions to access different kinds of workspaces shall be taken into account to guarantee that the same level of inclusiveness can be kept. Moreover, very costly shared workspaces, are not to be considered so as not to become a potential burden on the ERTRAC costs.

In the roadmapping processes across the Member States and the international countries tackled in this document, a number of best practices stand out. One such practice is the emphasis on stakeholder engagement and collaboration similar to what has proved to be a success factor for the ERTRAC roadmaps too, in fact ERTRAC is already applying this best practice as well as the other best practices that can be derived from the Member States and international analysis of roadmapping mechanisms. This includes the active involvement of government agencies, academic institutions, and private sector companies in supporting R&I within the Road Transport sector. This multi-stakeholder approach provides a broad range of perspectives, fostering a more comprehensive and effective roadmapping. Regulatory guidance and funding from government agencies, theoretical insights from academic institutions, and practical expertise from private sector companies furthermore collectively contribute to a robust roadmap as a result.

The integration of scientific and technological innovation into the roadmapping process is another recognized best practice. This reflects the understanding that keeping abreast of emerging technologies and trends can provide a competitive edge and facilitate long-term planning. In some countries, maintaining the quality of roadmap content and its format is achieved through public hearings and subsequent modifications based on feedback received. This ensures that the roadmap remains relevant, transparent, and responsive to public needs and concerns.

While the frequency of reviews and updates may vary depending on specific circumstances or R&I areas, there is a shared understanding that roadmaps should be regularly reviewed and updated. This ensures they remain relevant and aligned with evolving market trends, technological advancements, strategic goals, and national development plans.

Another common best practice is aligning the roadmap with national strategic goals and development plans. This alignment ensures that the roadmap serves as a path towards realizing the country's overarching vision.

Moreover, with the Member States and the international countries making the roadmaps publicly available on different websites and monitoring access or traffic, they can evaluate the impact and outreach of each roadmap. Encouraging reference to the associated roadmap for those seeking public funding also ensures that the roadmaps are practical and directly tied to the R&I needs.

Another take over is that the mapping of different entities in charge in the different EU Member States on Road Transport R&I roadmapping can easily be done with deep diving web searches, this is useful in any moment any ERTRAC Working Group, leaders and experts, may wish or need to get into direct consultation on specific R&I topics with any EU Member State to extend its networking activities.

The interplay between roadmaps and national/international funding mechanisms is also noteworthy. Roadmaps often serve as a basis for accessing funds by demonstrating a clear plan of action, expected results, and required resources. Conversely, existing national funding mechanisms may influence the creation of roadmaps as funds often come with specific conditions and targets. Although the specifics of this connection are not often described, there is a significant interplay between the two in the Member States and in the international countries, where the roadmaps guide the allocation of funds, while available funding shapes the roadmap's priorities and actions.

ANNEX I - Road Transport R&I Roadmapping Entities in other EU Member States

There are various organizations across Europe involved in Road Transport innovation R&I. Here are some of the organizations that get engaged in the European Member States beyond Austria, Belgium, Germany and Italy that have been analysed in this document:

- **Government Agencies:** departments or ministries responsible for transportation or research and development often have dedicated units or collaborations focusing on Road Transport innovation
- **Research Institutes/Universities:** academic institutions conduct significant research in transportation, often collaborating with governmental bodies or industry partners
- **Industry Associations/Clusters:** organizations within the transportation industry often participate in or support R&I efforts, sometimes in collaboration with government agencies or research institutes.

In the following section of this Annex, in alphabetical order per EU Member States, including all EU Member States not already tackled in the previous paragraphs, the major organizations and entities involved in Road Transport R&I roadmapping are listed per each EU Member State. Needless to mention that this list is not meant to be exhaustive, but representative of the Road Transport R&I roadmapping activities and stakeholders and can become an entry point for ERTRAC to extend its networking activities.

Bulgaria

Ministry of Transport, Information Technology, and Communications (MTITC). This governmental body oversees transportation policies and initiatives, likely involved in Road Transport R&I planning and coordination.

State Agency "Road Infrastructure". Responsible for the planning, construction, and maintenance of the road infrastructure in Bulgaria. They may have involvement in research related activities.

Bulgarian Academy of Sciences (BAS). Academic institution conducting various research projects, including those related to transportation and road infrastructure.

Universities and Research Institutes. Institutions such as the Technical University of Sofia, University of Architecture, Civil Engineering, and Geodesy, and other technical universities or research institutes might be engaged in transportation research.

Industry Associations. Organizations representing the transportation sector in Bulgaria, such as the Bulgarian Association for Land Mobility, might have involvement or interest in Road Transport R&I.

Croatia

Ministry of the Sea, Transport and Infrastructure. This governmental body oversees transportation policies and initiatives, likely involved in Road Transport R&I planning and coordination.

Croatian Roads (Hrvatske Ceste). Responsible for the construction and maintenance of roads in Croatia. They may have involvement in research related activities related to road infrastructure.

Universities and Research Institutes. Academic institutions like the University of Zagreb, University of Rijeka, and the Faculty of Transport and Traffic Sciences are likely involved in transportation research.

Croatian Chamber of Economy (Hrvatska gospodarska komora). Industry associations or chambers often participate or support R&I efforts within the transportation sector.

Croatian Transport and Logistics Cluster. Industry clusters or associations focused on transport and logistics may also be involved in Road Transport R&I.

Cyprus

Ministry of Transport, Communications and Works. The governmental body responsible for transportation policies and initiatives in Cyprus, likely involved in Road Transport R&I planning and coordination.

Public Works Department. Responsible for the planning, construction, and maintenance of road infrastructure in Cyprus. They might be engaged in research related activities related to roads and transportation.

Universities and Research Institutes. Academic institutions such as the Cyprus University of Technology, University of Cyprus, and other research institutes may conduct transportation related research.

Cyprus Chamber of Commerce and Industry (CCCI). Industry associations or chambers often participate or support R&I efforts within the transportation sector.

Cyprus Institute of Technology (CIT) with its involvement in technology and transportation related research.

Czech Republic

Ministry of Transport. The governmental body responsible for transportation policies and initiatives in the Czech Republic, likely involved in Road Transport R&I planning and coordination.

Czech Road and Motorway Directorate (ŘSD). Responsible for the management and maintenance of roads and motorways in the Czech Republic. They may be involved in research related activities related to road infrastructure.

Universities and Research Institutes. Academic institutions such as Czech Technical University in Prague (ČVUT), Brno University of Technology (VUT), and research institutes like the Czech Academy of Sciences may conduct transportation related research.

Czech Chamber of Commerce (HK ČR). Industry associations or chambers often participate or support R&I efforts within the transportation sector.

Czech Transport Research Centre (CDV). An organization focusing on transport research, innovation, and consulting, likely involved in Road Transport research initiatives.

Denmark

Ministry of Transport. Responsible for transportation policies and initiatives in Denmark. Likely involved in Road Transport R&I planning and coordination.

Danish Road Directorate (Vejdirektoratet). Responsible for planning, construction, and maintenance of roads and highways in Denmark. Engaged in research related activities related to road infrastructure.

Technical University of Denmark (DTU). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Danish Transport and Logistics Association (DTL). Industry associations often participate or support R&I efforts within the transportation and logistics sector.

State and Regional Authorities. Various regional authorities might also be involved in transportation R&I efforts.

The Danish Transport, Construction, and Housing Authority (Trafik-, Bygge- og Boligstyrelsen). This authority handles various aspects of transportation, construction, and housing, potentially including involvement in Road Transport research initiatives.

Estonia

Ministry of Economic Affairs and Communications. Responsible for transportation policies and initiatives in Estonia. Likely involved in Road Transport R&I planning and coordination.

Road Administration (Maanteeamet). Responsible for the management and maintenance of roads and highways in Estonia. Engaged in research related activities related to road infrastructure.

Tallinn University of Technology (TalTech). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Estonian Association of Transport Engineers (Eesti Transporditeeinseneride Liit). Industry associations often participate or support R&I efforts within the transportation sector.

Estonian Research Council. Coordinates and funds research activities in Estonia, including potential involvement in transportation related research projects.

Ministry of Education and Research. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

Finland

Ministry of Transport and Communications (MTC). Responsible for transportation policies and initiatives in Finland. Likely involved in Road Transport R&I planning and coordination.

Finnish Transport Infrastructure Agency (FTIA, Liikennevirasto). Responsible for the planning, construction, and maintenance of the transport infrastructure, including roads. Engaged in research related activities related to road infrastructure.

VTT Technical Research Centre of Finland. A leading research institute conducting various transportation related research, including Road Transport innovation and technology.

Aalto University. Academic institution with research departments focusing on transportation, urban planning, and technology, contributing to Road Transport research.

Finnish Transport Safety Agency (Trafi, Liikenteen turvallisuusvirasto). Responsible for overseeing traffic safety and regulations, potentially involved in Road Transport research initiatives related to safety.

Finnish Association of Civil Engineers (RIL). Industry associations often participate or support R&I efforts within the transportation sector.

Ministry of Education and Culture. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

France

Ministry of Ecology, Sustainable Development, and Energy (Ministère de la Transition Écologique et Solidaire). Responsible for transportation policies and initiatives in France. Likely involved in Road Transport R&I planning and coordination.

French Institute of Science and Technology for Transport, Development, and Networks (IFSTTAR - now integrated into IFSTTÉRA). A leading research institute focusing on transportation, conducting various Road Transport R&I projects.

National Center for Scientific Research (CNRS - Centre National de la Recherche Scientifique). One of Europe's largest research institutions, covering various scientific disciplines, including transportation and road infrastructure research.

École des Ponts ParisTech (ENPC). An engineering school known for its research in transportation and civil engineering, contributing to Road Transport research.

French Association of Automotive Engineers and Technicians (SIA - Société des Ingénieurs de l'Automobile). Industry associations often participate or support R&I efforts within the automotive and transportation sector.

French Road Union (Routes de France). An association representing the road industry, including companies and professionals involved in road infrastructure and transportation.

Agence Nationale de la Recherche (ANR). The French National Research Agency funding various research projects, including those related to transportation and road innovation.

As a very recent example, in December 2023 the French 2030 “Programme de Recherche Digitalization et decarbonation des Mobilitites” has been launched in France to co-fund related R&I projects.

Greece

Ministry of Infrastructure and Transport. Responsible for transportation policies and initiatives in Greece. Likely involved in Road Transport R&I planning and coordination.

Hellenic Institute of Transport (HIT). A research institute focusing on transportation studies, including Road Transport R&I.

National Technical University of Athens (NTUA). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Road Traffic Police (Elliniki Astynomia Dromou). Involved in traffic management and safety, potentially involved in Road Transport research initiatives related to safety.

Hellenic Association of Toll Road Network (HELLASTRON). Association representing the toll road industry in Greece, potentially engaged in research related to road infrastructure.

Hellenic Ministry of Education, Research, and Religious Affairs. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

Hellenic Association of Civil Engineers (TEE). Industry associations often participate or support R&I efforts within the transportation sector.

Hungary

Ministry for Innovation and Technology. Responsible for transportation policies and initiatives in Hungary. Likely involved in Road Transport R&I planning and coordination.

Budapest University of Technology and Economics (BME). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Hungarian Public Road Nonprofit Ltd. (Magyar Közút Nonprofit Zrt.). Responsible for the construction and maintenance of roads and highways in Hungary. Engaged in research related activities related to road infrastructure.

Hungarian Academy of Sciences (MTA). A leading research institution covering various scientific disciplines, including transportation and road infrastructure research.

Hungarian Road Haulage Association (MKFE). Industry associations often participate or support R&I efforts within the transportation and logistics sector.

National Research, Development, and Innovation Office (NKFIH). Coordinates and funds research activities in Hungary, potentially including transportation related research projects.

Ministry of Education. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

Ireland

Department of Transport. Responsible for transportation policies and initiatives in Ireland. Likely involved in Road Transport R&I planning and coordination.

Transport Infrastructure Ireland (TII). Responsible for the planning, construction, and maintenance of national roads and public transport infrastructure. Engaged in research related activities on road infrastructure.

National Roads Authority (NRA). Previously responsible for national road construction and maintenance; it has now merged into Transport Infrastructure Ireland (TII).

University College Dublin (UCD). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Road Safety Authority (RSA). Involved in promoting road safety and potentially involved in Road Transport research initiatives related to safety measures and regulations.

Science Foundation Ireland (SFI). A funding agency supporting scientific and engineering research, including transportation related studies.

Institute of Technology Carlow. Another academic institution that may be involved in transportation research.

Latvia

Ministry of Transport. Responsible for transportation policies and initiatives in Latvia. Likely involved in Road Transport R&I planning and coordination.

Latvian State Roads (Latvijas Valsts Ceļi). Responsible for the planning, construction, and maintenance of state roads and highways in Latvia. Engaged in research related activities related to road infrastructure.

Riga Technical University (RTU). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Latvian Academy of Sciences. A research institution covering various scientific disciplines, including transportation and road infrastructure research.

Latvian Automobile Association (LAA). Industry associations often participate or support R&I efforts within the automotive and transportation sector.

Latvian Council of Science. Coordinates and funds research activities in Latvia, potentially including transportation related research projects.

Latvian Association of Civil Engineers. Industry associations representing professionals in civil engineering and construction fields, potentially involved in road infrastructure related research.

Lithuania

Ministry of Transport and Communications. Responsible for transportation policies and initiatives in Lithuania. Likely involved in Road Transport R&I planning and coordination.

Lithuanian Road Administration (LAKD). Responsible for the management and maintenance of roads and highways in Lithuania. Engaged in research related activities related to road infrastructure.

Vilnius Gediminas Technical University (VGTU). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Lithuanian Academy of Sciences. A research institution covering various scientific disciplines, including transportation and road infrastructure research.

Association of Lithuanian Chambers of Commerce, Industry and Crafts (LPPARA). Industry associations often participate or support R&I efforts within the transportation sector.

Research Council of Lithuania. Coordinates and funds research activities in Lithuania, potentially including transportation related research projects.

Lithuanian Road Builders Association (LARB). Association representing professionals and companies involved in road construction, potentially involved in road infrastructure related research.

Luxemburg

Ministry of Mobility and Public Works (Ministère de la Mobilité et des Travaux publics). Responsible for transportation policies and initiatives in Luxembourg. Likely involved in Road Transport R&I planning and coordination.

Administration des Ponts et Chaussées (Roads and Bridges Administration). Responsible for the planning, construction, and maintenance of roads and bridges in Luxembourg. Engaged in research related activities related to road infrastructure.

Luxembourg Institute of Science and Technology (LIST). A research institute conducting various transportation related research, including Road Transport innovation and technology.

University of Luxembourg. Academic institution conducting research in various fields, including transportation and mobility studies.

Luxembourg Automotive Components Cluster (LAC). Industry clusters or associations focused on the automotive and transportation sector. They might be involved in Road Transport R&I.

Fonds National de la Recherche (FNR). The National Research Fund of Luxembourg funds research projects across various disciplines, potentially including transportation related research.

Malta

Ministry for Transport, Infrastructure and Capital Projects. Responsible for transportation policies and initiatives in Malta. Likely involved in Road Transport R&I planning and coordination.

Transport Malta. The authority responsible for transportation and road infrastructure management in Malta. They might engage in research related activities related to Road Transport and safety.

University of Malta. Academic institution that may conduct research in transportation related fields, contributing to Road Transport R&I.

Malta Chamber of Commerce, Enterprise and Industry. Industry associations might be involved or support R&I efforts within the transportation sector.

Malta Council for Science and Technology (MCST). Responsible for coordinating and funding scientific R&I in Malta, potentially including transportation related research projects.

Poland

Ministry of Infrastructure. Responsible for transportation policies and initiatives in Poland. Likely involved in Road Transport R&I planning and coordination.

General Directorate for National Roads and Motorways (GDDKiA - Generalna Dyrekcja Dróg Krajowych i Autostrad). Responsible for the planning, construction, and maintenance of national roads and highways in Poland. Engaged in research related activities related to road infrastructure.

Polish Road Transport Authority (TDT). Involved in regulating and supervising Road Transport, potentially participating in Road Transport research initiatives.

Warsaw University of Technology (Politechnika Warszawska). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Polish Chamber of Commerce for Road Construction (PIARC - Polska Izba Drogownictwa). Industry associations often participate or support R&I efforts within the road construction and transportation sector.

National Centre for Research and Development (NCBR - Narodowe Centrum Badań i Rozwoju). Coordinates and funds research activities in Poland, potentially including transportation related research projects.

Polish Association of Engineers and Technicians of Transportation (SITK RP - Stowarzyszenie Inżynierów i Techników Komunikacji Rzeczpospolitej Polskiej).

Association representing professionals in transportation engineering, involved in industry advancements and research.

Portugal

Ministry of Infrastructure and Housing (Ministério das Infraestruturas e da Habitação). Responsible for transportation policies and initiatives in Portugal. Likely involved in Road Transport R&I planning and coordination.

National Laboratory of Civil Engineering (LNEC - Laboratório Nacional de Engenharia Civil). A research institute focusing on civil engineering, including transportation related research and road infrastructure.

Instituto Superior Técnico (IST). An engineering school and research institution that conducts transportation related research, including Road Transport innovation and technology.

Portuguese Road Association (APVC - Associação Portuguesa de Veículos Clássicos). Industry associations might be involved or support R&I efforts within the automotive and transportation sector.

Foundation for Science and Technology (FCT - Fundação para a Ciência e a Tecnologia). Funds and supports scientific research across various disciplines, potentially including transportation related research projects.

Portuguese Association of Engineers (Ordem dos Engenheiros). An association representing engineers, including those involved in transportation engineering and research.

Portuguese Institute of Mobility and Transport (IMT - Instituto da Mobilidade e dos Transportes). Involved in regulating and supervising transport, including Road Transport, and potentially participating in Road Transport research initiatives.

Romania

Ministry of Transport. Responsible for transportation policies and initiatives in Romania. Likely involved in Road Transport R&I planning and coordination.

National Company for Road Infrastructure Management (CNAIR - Compania Națională de Administrare a Infrastructurii Rutiere). Responsible for the planning, construction, and maintenance of national road infrastructure. Engaged in research related activities related to road infrastructure.

Technical University of Civil Engineering Bucharest (UTCB). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Romanian Road Transport Association (ARR). Industry associations often participate or support R&I efforts within the transportation sector.

National Research and Development Institute for Traffic and Road Infrastructure (INCERC). Engaged in research on traffic and road infrastructure development, including Road Transport research.

Romanian Academy. A research institution covering various scientific disciplines, including transportation and road infrastructure research.

Ministry of Education and Research. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

Slovakia

Ministry of Transport and Construction. Responsible for transportation policies and initiatives in Slovakia. Likely involved in Road Transport R&I planning and coordination.

National Motorway Company (NDS - Národná diaľničná spoločnosť). Responsible for the planning, construction, and maintenance of motorways in Slovakia. Engaged in research related activities related to road infrastructure.

Slovak University of Technology in Bratislava (STU). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Slovak Chamber of Commerce and Industry (SOPK - Slovenská obchodná a priemyselná komora). Industry associations often participate or support R&I efforts within the transportation sector.

Transport Research Center (Dopravný výskumný ústav). Involved in research related to transportation, including road infrastructure and transport planning.

Slovak Academy of Sciences. A research institution covering various scientific disciplines, including transportation and road infrastructure research.

Ministry of Education, Science, Research, and Sport. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

Slovenia

Ministry of Infrastructure. Responsible for transportation policies and initiatives in Slovenia. Likely involved in Road Transport R&I planning and coordination.

Slovenian Infrastructure Agency (Direkcija Republike Slovenije za infrastrukturo). Responsible for planning, construction, and maintenance of infrastructure, including roads. Engaged in research related activities related to road infrastructure.

University of Ljubljana. Academic institution conducting transportation related research, including Road Transport innovation and technology.

Chamber of Commerce and Industry of Slovenia (GZS - Gospodarska zbornica Slovenije). Industry associations often participate or support R&I efforts within the transportation sector.

Institute of Traffic and Transport Ljubljana. Engaged in research on traffic and transport, including Road Transport R&I.

Slovenian Academy of Sciences and Arts. A research institution covering various scientific disciplines, potentially including transportation and road infrastructure research.

Ministry of Education, Science, and Sport. Involved in coordinating educational and research policies, potentially supporting Road Transport research initiatives.

Spain

Ministry of Transport, Mobility, and Urban Agenda (Ministerio de Transportes, Movilidad y Agenda Urbana). Responsible for transportation policies and initiatives in Spain. Likely involved in Road Transport R&I planning and coordination.

Spanish Road Association (Asociación Española de la Carretera). Engaged in promoting research, development, and innovation in road infrastructure and transportation.

Spanish Road Technology Platform (PTC). A collaborative platform bringing together stakeholders to promote innovation and technology in road infrastructure.

Centro de Estudios y Experimentación de Obras Públicas (CEDEX). Research centre focused on civil engineering, including transportation related studies and road infrastructure research.

Universities and Research Institutions. Several universities and research centres across Spain conduct transportation related research, contributing to Road Transport innovation and technology.

Spanish Institute of Engineering. An institution involving professionals in engineering fields, potentially involved in Road Transport R&I efforts.

Ministry of Science and Innovation. Involved in coordinating and supporting R&I initiatives in various sectors, including transportation.

Sweden

Swedish Transport Administration (Trafikverket). Responsible for the planning, construction, and maintenance of roads and railways in Sweden. Engaged in research related activities related to road infrastructure and transportation.

Swedish National Road and Transport Research Institute (VTI - Statens väg- och transportforskningsinstitut). A national research institute focused on transportation related research, including Road Transport innovation and technology.

Royal Institute of Technology (KTH). Academic institution conducting transportation related research, including Road Transport innovation and technology.

Swedish Association of Road Transport Companies (Sveriges Åkeriföretag). Industry associations often participate or support R&I efforts within the transportation sector.

Swedish Agency for Innovation Systems (Vinnova). Funds and supports innovation and research projects, potentially including transportation related research.

Swedish Road Administration (SRA - Vägverket). Previously responsible for the management of roads in Sweden, it has now been merged into the Swedish Transport Administration (Trafikverket).

Ministry of Infrastructure. Involved in setting policies and regulations for transportation, potentially supporting Road Transport research initiatives.

The Netherlands

Ministry of Infrastructure and Water Management (Ministerie van Infrastructuur en Waterstaat). Responsible for transportation policies and initiatives in the Netherlands. Likely involved in Road Transport R&I planning and coordination.

Rijkswaterstaat. The executive agency of the Ministry of Infrastructure and Water Management responsible for the design, construction, management, and maintenance of the main infrastructure facilities in the Netherlands, including roads. Engaged in research related activities related to road infrastructure.

TNO (Netherlands Organisation for Applied Scientific Research). A research organization conducting various transportation related research, including Road Transport innovation and technology.

Delft University of Technology (TU Delft). Academic institution conducting R&I on transportation.

List of abbreviations and acronyms

Acronym	Meaning
2Zero	Towards Zero emission road transport (2Zero) co-programmed Partnership
AIT	Austrian Institute of Technology
ALICE	Alliance for Logistics Innovation through Collaboration in Europe
BELSP0	BELgian Science Policy Office
A3PS	Austrian Association for Advanced Propulsion Systems
APC	UK Advanced Propulsion Centre
CAD	Connected Automated Driving
CLEPA	European Association of Automotive Suppliers
CSA	Coordination and Support Action
CTN	Cluster Trasporti Italia
D	Deliverable
EARPA	European Automotive Research Partners Association
EC	European Commission
EGVIAfor2ZERO	European Green Vehicles Initiative Association for the 2Zero partnership
ERRAC	European Rail Research Advisory Council
ERTRAC	European Road Transport Research Advisory Council
ESBS	Electronics and Software Based Systems
ETP	European Technology Platform
EUCAR	European Council for Automotive R&D
FEBIAC	Fédération de l'Industrie de l'Automobile et du Cycle en Belgique et au Grand-Duché de Luxembourg
FFG	Austrian Research Promotion Agency
H2ICE	Hydrogen Internal Combustion Engine
M	Month
MaaS	Mobility as a Service
MS	Milestone

Acronym	Meaning
MUR	Italian Ministry for Universities and Research
OEM	Original Equipment Manufacturer
NEV	New Energy Vehicle
PNR	Programma Nazionale per la Ricerca Italiana
PPP	Private Public Partnership
R&D	Research and Development
R&I	Research and Innovation
RTR	Road Transport Research
SDGs	Sustainable Development Goals
SM	Social Media
SMEs	Small and Medium-sized Enterprises
SRA	Strategic Research Agenda
SRIA	Strategic Research and Innovation Agenda
STRIA	Strategic Transport Research and Innovation Agenda
SW	Software
UN	United Nations
VDA	Verband Deutscher Automobilindustrie
VDI	Verein Deutscher Ingenieure
TRA	Transport Research Arena
WG	Working Group
WP	Work Package
ZEV	Zero Emission Vehicle

References

Acknowledgement:

“A huge number of web sources and related public documentations have been consulted for the preparation of this document with reference to the analysis performed in the different countries. All sources are duly thanked here.”

(R1) ERTRAC the European Technology Platform (ETP) for Road Transport
<https://www.ertrac.org/>

(R2) STREnGth_M
https://www.ertrac.org/support-actions/strength_m/

(R3) FUTURE-HORIZON
<https://www.ertrac.org/support-actions/future-horizon/>

(R4) FUTURE-RADAR
<https://www.ertrac.org/support-actions/future-radar/#:~:text=FUTURE%2DRA-DAR%20is%20the%20support.competitive%20Euro-pean%20road%20transport%20system.>

(R5) FOSTER-ROAD
<https://www.ertrac.org/foster-road/>

(R6) European Commission Strategic Transport R&I Agenda (STRIA) https://research-and-innovation.ec.europa.eu/research-area/transport/stria_en

(R7) EUCAR European Council for Automotive R&D
<https://www.eucar.be/>

(R8) CCAM Cooperative, Connected and Automated Mobility Association
<https://www.ccam.eu/>

(R9) CLEPA European Association of Automotive Suppliers
<https://clepa.eu/>

(R10) ERTICO ITS Europe European Road Transport Telematics Implementation Coordination Organisation
<https://ertico.com/>

(R11) EARPA Association of Automotive R&D Organisations
<https://www.earpa.eu/earpa/home>