STREnGth_M
Strengthening EU
Road Transport R&I

Deliverable 1.1

Barriers for deployment of research results

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List of abbreviations and acronyms

Acronym	Meaning
2ZERO	Towards Zero Emission Road Transport European Partnership
AD	Automated/Autonomous Driving
ADS	Automated/Autonomous Driving System
ALICE	Alliance for Logistics Innovation through Collaboration in Europe
BEV	Battery Electric Vehicle
CCAM	Connected Cooperative Automated Mobility
CSA	Coordination and Support Action
D	Deliverable
DSO	Distribution System Operators (energy distribution)
ERTRAC	European Road Transport Research Advisory Council
ERS	Electric Road System
EV	Electric Vehicle
GDPR	General Data Protection Regulation
HCV	Heavy Commercial Vehicles
HMI	Human Machine Interface
HVO	Hydrotreated Vegetable Oil – Renewable Fuel
IOT	Internet of Things
M	Month
MaaS	Mobility as a Service
MS	Milestone
LCA	Life Cycle Assessment
PHEV	Plug-In Hybrid Electric Vehicle
R&I	Research and Innovation
RTR	Road Transport Research
SDGs	Sustainable Development Goals
SM	Social Media
SRIA	Strategic Research and Innovation Agenda
TaaS	Transport as a Service

TCO	Total Cost of Ownership
TRA	Transport Research Arena
UFP	Ultra Fine Particles
UN	United Nations
V2G	Vehicle to Grid
VECTO	Vehicle Energy Consumption Calculation Tool
WP	Work Package
ZEV	Zero Emission Vehicles

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1 Introduction to the report

1.1 Project abstract and reference to the work plan

STREnGth_M is a coordination and support action (CSA) co-funded by the European Commission (EC) under 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 CSA will contribute to a further harmonisation of research and innovation activities and, therefore, to European strategies for future transport systems. The action should also help reduce the time to market of new mobility solutions, by stimulating a wider participation in EU activities and supporting worldwide dissemination of the results therefrom. In addition, this CSA will support climate action and air quality improvement in line with the Green Deals objectives and contribute to the United Nations (UN) Sustainable Development Goals.

The STREnGth_M project will contribute to the planning of research and innovation 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. Further, STREnGth_M will analyse research, innovation and cooperation capacities in Member States, explore funding instruments at national, and regional levels, and assess national and regional roadmaps. Within STREnGth_M, the global progress of electric mobility will be tracked whilst measuring the feasibility of innovative solutions for prospective and emerging markets in Africa, Asia and Latin America. Thus, STREnGth_M will strengthen existing and even forge new links between European, national, and regional programmes, and support structures for international cooperation task forces. The project partners will also identify barriers that may exist for the deployment of research results at European and international levels, and they will identify education and training actions to contribute to capacity building. In order to inform and engage the stakeholder community, policy makers, the civil society, the consortium will develop dissemination strategies, support the dissemination and organisation of European and international road transport research related events. This way, the dissemination of the contribution from road transport to the realization of the European Green Deal targets and the Paris Agreement can be ensured. Via the establishment of the Multiplier Group, the engagement of the various stakeholders will be facilitated during the project.

Work package overview

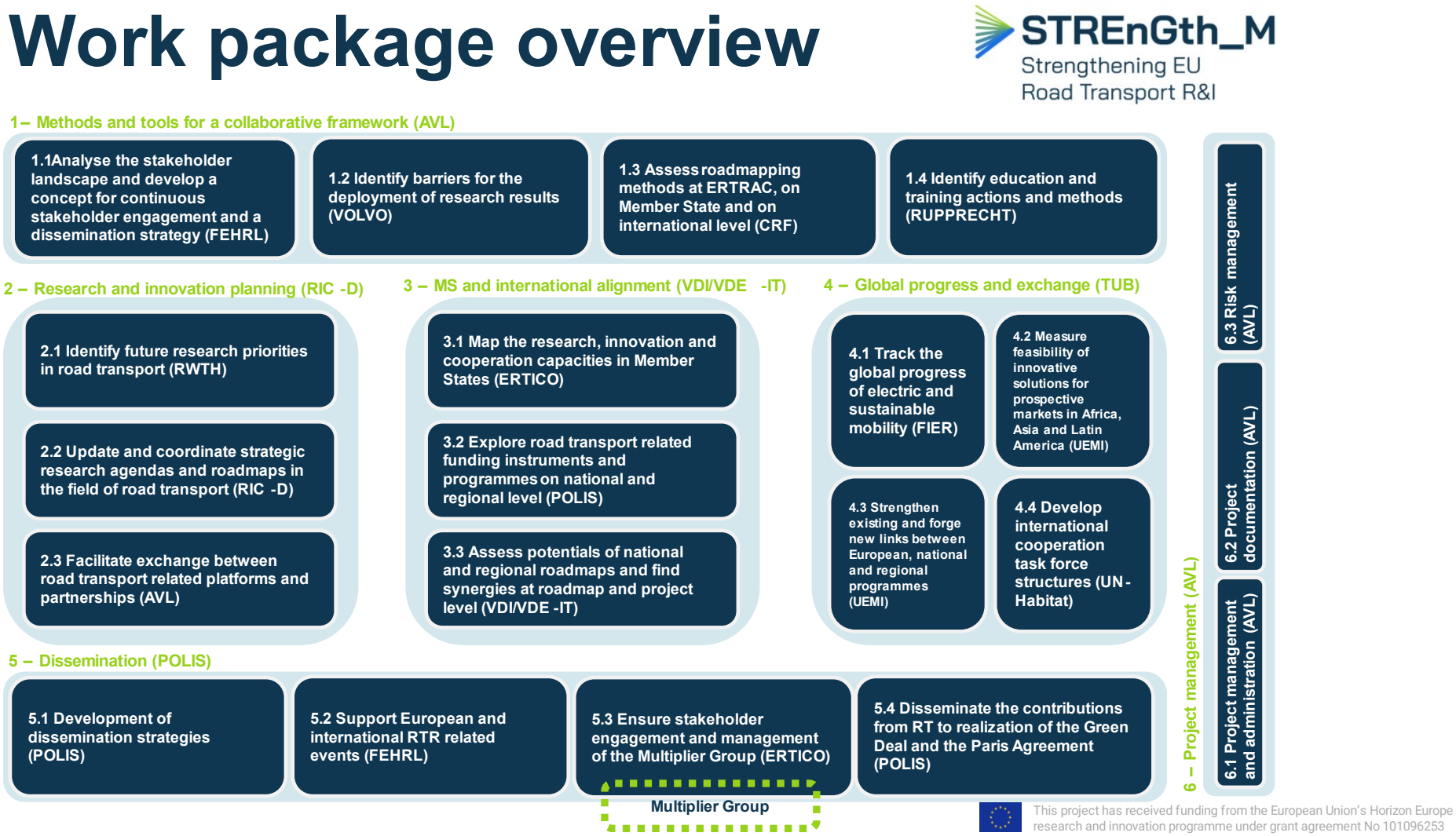

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Figure 1 Work package overview

1.2 Related work package and task

The work in this report relates to work package 1 focusing on methods and tools for a collaborative framework. This work package focusses on mapping and analysing the stakeholder landscape for road transport research in Europe and internationally, concepts for stakeholder engagement, analysing and evaluating road mapping mechanisms at ERTRAC, at Member State and at international level and identifying education and training actions for European and international stakeholders.

The task T1.2 has, within this work package, identified barriers and challenges for the deployment of research results.

1.3 Objectives and scope of this report

The objective of this report is to identify barriers and challenges for the deployment of research results in products and services for climate change, air quality, safety. The scope of these products and services are for the benefits of future sustainable mobility and transport solutions.

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

The report provides the results of the work done in Task 1.2 of the *STREnGth_M* project, a coordination and support project that is closely linked to the European Technology Platform ERTRAC, the European Road Transport Research Advisory Council, and the European co-programmed partnerships 2ZERO and CCAM. There are also close connections to the European partnerships Clean Hydrogen and Batteries for Europe. In addition there are close links to the European Technology Platform ALICE, the Alliance for Logistics Innovation through collaboration in Europe and Internationally through the International Collaboration program.

1.5 Methodology

The Methodology used for this task has been to analyse an extract of the European funded projects presented at the annual research results conference, RTR2024[1]. The list of projects approached is listed in the Appendix.

The RTR conference moderators and some of the projects managers were contacted to respond to a number of questions as listed in chapter 3. Each response was analysed and aggregated individually. This was followed by an online workshop with the task participants to collectively review and analyse the results.

[1] https://rtrconference.eu/rtr-2024/

2 Barriers for deployment of research results

2.1 Background

2.1.1 Introduction

The deployment of research results refers to the process of taking the findings and results of research projects and putting them into practical use or application. This could involve implementing the research findings in real-world settings, developing products or services based on the research, or sharing the results with relevant stakeholders to inform decision-making or policy development. It essentially involves making the research results accessible and useful beyond the academic or research context.

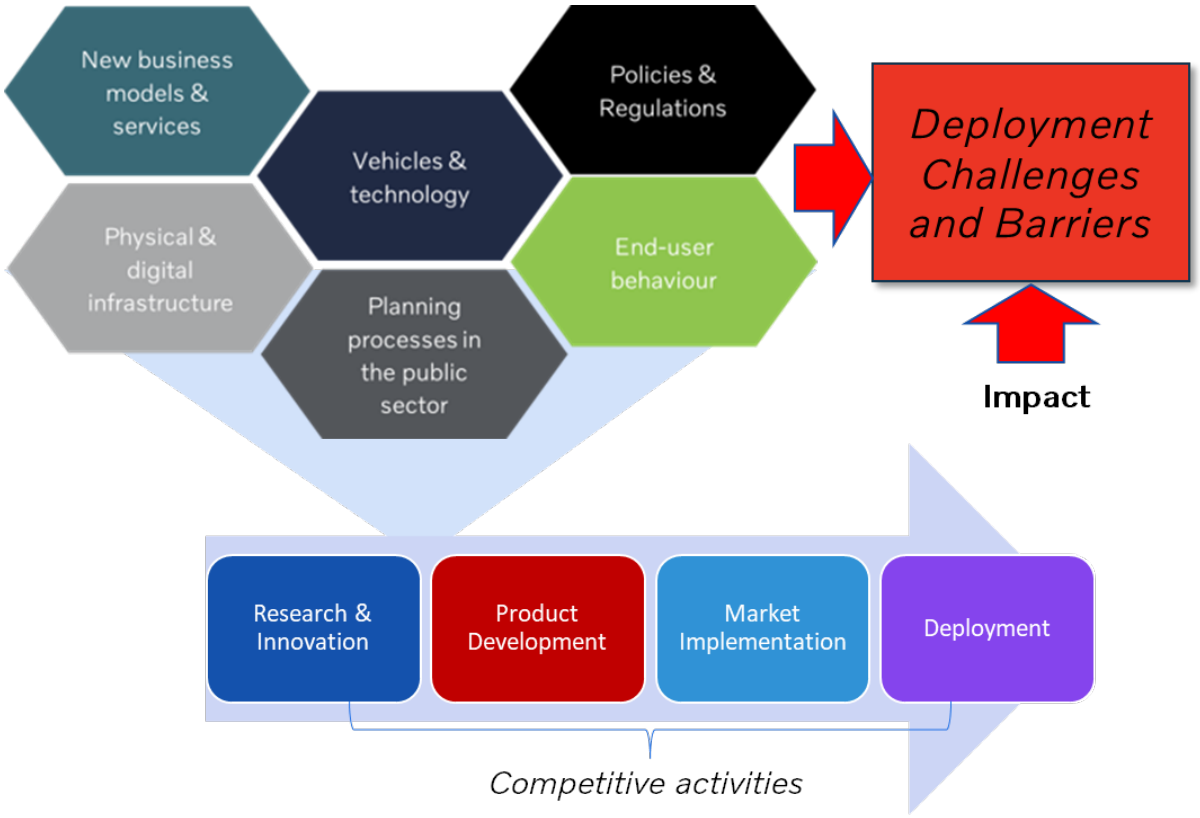

Figure 2 Impact of Deployment Challenges and Barriers

2.1.2 General areas that influence development of products & services

The following areas are important to consider when performing research and innovation of new products and services of mobility and transport solutions. In addition it is important to consider the systemic view on the mobility transition.

a) New business models & services

New business models and services can support the deployment of research results in several ways. Firstly, they can provide funding and resources to further develop and scale up research findings into practical applications. By investing in research projects, businesses can help bring innovative ideas to market more quickly. Additionally, businesses can collaborate with researchers to co-create solutions that address real-world challenges. This can help ensure that research results meet the needs of end-users and are more likely to be adopted in practice.

Furthermore, new business models can help commercialize research outcomes by creating sustainable revenue streams. By identifying market opportunities and developing value propositions around research findings, businesses can drive the adoption and implementation of innovative solutions. Overall, new business models and services play a crucial role in supporting the deployment of research results by providing the necessary resources, expertise, and market access to translate research findings into tangible impact.

b) Physical & Digital infrastructure

Physical infrastructure provides the necessary resources for researchers to conduct experiments, collect data, and test hypotheses. Having access to state-of-the-art physical infrastructure can accelerate the research process and enable researchers to generate high-quality results. Additionally, physical infrastructure like road networks, manufacturing plants or distribution centres can support the production and dissemination of research-based products or services to end-users.

Digital infrastructure, including communication networks, data storage systems, and software platforms, facilitates the sharing and dissemination of research findings. Digital tools and technologies enable researchers to collaborate across geographical boundaries, access vast amounts of data for analysis, and communicate their results to a wider audience. For example, online platforms for publishing research papers or hosting virtual conferences can help researchers reach users and stakeholders and spark collaborations with other experts in the field.

Both physical and digital infrastructure are essential components in the deployment of research results, as they provide the necessary support systems for researchers to conduct their work, share their findings, and translate their discoveries into real-world applications.

c) Vehicle technologies

Vehicle technologies are playing a significant role in the deployment of research results in various fields. One keyway in which vehicle technologies contribute to this is through the development of more efficient and sustainable transportation solutions. Research in areas such as electric vehicles, autonomous driving, and alternative fuels has led to the creation of innovative technologies that are helping to reduce carbon emissions, improve air quality, traffic safety, and enhance overall transportation efficiency.

Additionally, vehicle technologies are also being used to support research efforts in fields such as urban planning, public health, and environmental science. For example, data collected from sensors and positioning systems in vehicles can provide valuable insights into traffic patterns,

air quality levels, and infrastructure usage, which can inform research studies and policy decisions.

Advancements in vehicle technologies are enabling researchers to conduct fieldwork and data collection more effectively. For instance, drones and autonomous vehicles equipped with various sensors and cameras can be used to gather data in remote or hazardous environments, allowing researchers to study and analyse phenomena that were previously inaccessible.

Overall, vehicle technologies are playing a crucial role in supporting the deployment of research results by providing innovative solutions for transportation, data collection, and research collaboration across various disciplines.

d) Planning processes for the public sector

Planning processes in the public sector play a vital role in facilitating the deployment of research findings and ensuring that they have a meaningful impact on society. By incorporating research into their planning processes, public sector organizations can make informed decisions, allocate resources effectively, and address key challenges facing their communities.

One way in which planning processes contribute to the deployment of research is by setting clear goals and objectives based on evidence and data. Research findings can help identify priority areas for intervention, establish performance metrics, and guide the development of strategies to achieve desired outcomes. By integrating research into their planning efforts, public sector organizations can ensure that their initiatives are grounded in sound evidence and are more likely to succeed.

Research can provide a common understanding of complex issues, facilitate collaboration among stakeholders, and promote the sharing of knowledge and best practices. By fostering a culture of evidence-based decision-making, planning processes can help ensure that research findings are effectively translated into policy and practice.

Furthermore, planning processes in the public sector can also support the dissemination and implementation of research results. By incorporating mechanisms for monitoring and evaluation, public sector organizations can track the progress of research-based initiatives, measure their impact, and make adjustments as needed. This iterative approach to planning and implementation helps to ensure that research results are effectively deployed and contribute to positive outcomes for the community.

In summary, planning processes in the public sector are essential for leveraging research to inform decision-making, drive innovation, and address societal challenges. By integrating research into their planning efforts, public sector organizations can maximize the impact of research findings and create positive change for the benefit of society as a whole.

e) Policies & Regulations

Research results play a crucial role in shaping the development and deployment of policies and regulations across the transport sectors. When policymakers have access to robust and reliable research findings, they can make more informed decisions that are based on evidence and data. Research results provide insights into the effectiveness of existing policies, identify areas for improvement, and inform the development of new regulations to address emerging

challenges. For example, research on the impact of climate change may influence the implementation of environmental policies aimed at reducing greenhouse gas emissions and promoting sustainable practices.

Research results also help policymakers understand the economic, social and environmental implications of proposed regulations, such as the cost-effectiveness of subsidies or the benefits of investing in transport infrastructure. Studies on social equity in transport can inform policies that ensure all population segments have access to affordable and efficient mobility options, also addressing the needs of underserved communities. Additionally, research results help policymakers strike a balance between economic growth and environmental sustainability.

f) End user perspectives

The end user plays a crucial role in supporting the deployment of research results. When end users, such as individuals, communities, businesses, or organizations, are receptive to and engaged with research findings, they are more likely to adopt and implement the recommendations derived from the research. Increasingly important is to consider the systemic perspective where the enabling environment plays an equally important role to provide a mobility solution for the end user. It is also important to consider the solution provider and operational aspects delivering a service to the end-users. Here are a few ways in which end user behaviour can support the deployment of research results:

- Awareness and Understanding: End users need to be aware of the research results and understand their implications. By actively seeking out information, participating in knowledge-sharing activities, and engaging with researchers and experts, end users can gain a deeper understanding of the research and its relevance to their own context. An enabling environment is critical for raising awareness and understanding among end users. Simply disseminating information is not enough; there must be structured efforts to make research findings accessible and relevant to end users. This can involve targeted communication strategies, education programs, demonstrations, pilots and interactive platforms that facilitate knowledge sharing and engagement with researchers and experts. A well-designed enabling environment ensures that end users comprehend the implications of research and see its relevance to their context.
- Willingness to Change: End users must be open to changing their behaviours, practices, or policies based on the research findings. This may involve overcoming resistance to change, challenging existing norms or beliefs, and being willing to try new approaches or solutions that are supported by research evidence. Policymakers and organizations must work together to create conditions that make it easier for end users to transition to evidence-based practices, overcoming resistance and altering entrenched norms. .
- Collaboration and Participation: End users can support the deployment of research results by actively participating in the research process, providing feedback, and collaborating with researchers and policymakers to co-create solutions. By involving end users in the design, implementation, and evaluation of research-based initiatives, the likelihood of successful deployment and impact is increased. This involvement can be facilitated through public consultations, focus groups, workshops, and feedback mechanisms. Researchers, policymakers, and community leaders play a crucial role in organizing these activities and ensuring that end users' voices are heard and valued.

- Advocacy and Influence: End users can also play a role in advocating for the adoption of research results within their own communities or organizations. By sharing information, raising awareness, and mobilizing support for evidence-based practices, end users can help drive change and promote the uptake of research results.

Overall, the end user perspectives are characterized by awareness, willingness to change, collaboration, and advocacy can significantly support the deployment of research results and contribute to positive outcomes for individuals, communities, businesses, organisations, and society as a whole.

2.1.3 Product & Services development phases

From an industrial perspective development of products and services occurs in different phases, as listed below.

g) Research & Advanced Engineering

During the development phase of research and advanced engineering, researchers and industrial innovators work to translate theoretical knowledge and ideas into practical applications and solutions. This phase involves refining concepts, conducting experiments, testing prototypes, and iterating on designs to create tangible products, processes, or services that address specific needs or challenges. The research and advanced engineering phase typically follow the ideation and exploration stages of the research and innovation process and precedes the product development stages. Key aspects of this phase include:

- Collaboration and Partnerships: Collaboration with industry partners, stakeholders, and end users is essential during the research and advanced engineering phase. By engaging with relevant stakeholders, researchers can ensure that their innovations meet real-world needs, align with market demands, and have a greater chance of successful deployment.
- Prototyping: Researchers and innovators create prototypes or models to test and validate their ideas. Prototyping allows them to gather feedback, identify potential issues, and make improvements before moving forward with full-scale development.
- Testing and Validation: During this phase, researchers conduct experiments, trials, and simulations to assess the performance, functionality, and feasibility of their innovations. Testing helps to verify the effectiveness of the proposed solutions and identify any areas that require further refinement.
- Iterative Design: This phase often involves an iterative process, where researchers make incremental changes and refinements based on feedback and test results. This iterative approach allows for continuous improvement and optimization of the innovation.
- Regulatory Compliance: Researchers must also consider regulatory requirements and standards during the development phase. Compliance with regulations ensures that the innovation meets legal and safety requirements and can be effectively brought to market.

Overall, the research and advanced engineering phase of research and innovation is a critical stage where ideas are transformed into practical solutions through prototyping, testing, iteration, collaboration, and regulatory compliance. This phase is essential for turning innovative concepts into tangible outcomes that can make a meaningful impact on society, industry, and the economy.

h) Product Development

During the product development phase of new products and services, companies focus on bringing their innovative ideas to life by designing, creating, and refining the final offerings that will be introduced to the market.

Ideally the product development phase should build in the results from the previous research and advanced engineering phase. But it is important to consider the complexity of this transition and it is often a challenge to manage this transition where different organisations, mindsets, competencies and processes apply. In addition commercial aspects of confidentiality, competition compliance and considerable larger financial investments during the product development phase.

The product development phase involves a series of steps and activities aimed at transforming concepts into tangible products or services that meet customer needs and expectations. The simplified key aspects of the product development phase include:

- Concept Development: Companies start by defining the concept for the new product or service, including its features, benefits, target market, and value proposition. This stage involves brainstorming, market research, and idea generation to identify opportunities and develop a clear vision for the offering. Results from research and advanced engineering provides crucial input before selecting and developing concepts.
- Design and Prototyping: Once the concept is established, companies move on to the design phase, where they create detailed specifications, sketches, and prototypes of the product or service. Designers and engineers work together to develop a functional and aesthetically pleasing solution that aligns with the initial concept. Preparation for manufacturing, production and product maintenance will also be considered.
- Testing and Validation: During this stage, companies conduct testing and validation to ensure that the product or service meets quality standards, performance requirements, and customer expectations. Testing may involve user feedback, focus groups, usability studies, and technical assessments to identify any issues or areas for improvement.
- Iterative Development: The product development phase often involves an iterative process of refinement and optimization. Companies gather feedback from stakeholders, make adjustments to the design or features, and iterate on the prototype to enhance the final product or service.
- Manufacturing and Production: Once the design is finalized and validated, companies move into the manufacturing and production stage. This involves sourcing materials, setting up production processes, and scaling up operations to produce the new product or service in larger quantities.
- Marketing and Launch: As the product or service nears completion, companies develop marketing strategies, promotional campaigns, and launch plans to introduce the offering to the market. This stage involves creating awareness, generating interest, and driving demand for the new product or service.

Overall, the product development phase of new products and services is a critical stage in the innovation process, where companies transform ideas into market-ready offerings through concept development, design, testing, iteration, manufacturing, and launch activities. By

effectively managing the product development process, companies can bring innovative solutions to market successfully and achieve competitive advantage in their industry.

i) Market Implementation

During the phase of market implementation of products and services, companies focus on introducing their offerings to the target market, generating sales, and building brand awareness. This phase involves a series of strategic activities aimed at effectively launching and promoting the product or service to drive customer adoption and achieve business objectives. Key aspects of the market implementation phase include:

- Go-to-Market Strategy: Companies develop a comprehensive go-to-market strategy that outlines how the product or service will be positioned, promoted, and distributed to the target audience. This strategy includes pricing, distribution channels, marketing tactics, and sales approaches to maximize market penetration and revenue generation.
- Sales and Distribution: Companies establish sales channels and distribution networks to make the product or service accessible to customers. This may involve partnering with retailers, distributors, or online platforms to reach a wider audience and drive sales.
- Marketing and Promotion: Companies create marketing campaigns and promotional activities to raise awareness, generate interest, and drive demand for the product or service. Marketing efforts may include advertising, public relations, social media, content marketing, and other tactics to reach and engage the target market.
- Customer Acquisition: Companies focus on acquiring customers through targeted marketing campaigns, sales initiatives, and customer engagement strategies. This may involve offering promotions, discounts, or incentives to encourage customers to try the product or service and make a purchase.
- Customer Feedback and Iteration: Companies gather feedback from customers, monitor sales performance, and analyse market trends to evaluate the success of the market implementation phase. Based on this feedback, companies may make adjustments to their marketing strategies, pricing, product features, or distribution channels to optimize performance and drive growth.
- Scaling and Expansion: As the product or service gains traction in the market, companies may focus on scaling up operations, expanding into new markets, or introducing additional product variants or service offerings to meet evolving customer needs and preferences.

Overall, the market implementation phase of products and services is a critical stage in the product lifecycle where companies focus on driving customer adoption, generating revenue, and building brand loyalty. By effectively executing their go-to-market strategy, companies can successfully introduce their offerings to the market, achieve sales targets, and establish a strong market presence.

j) Deployment

The deployment of products and services into a market refers to the process of making the offerings available to customers and ensuring that they are effectively delivered, implemented, and supported. Deployment involves a series of strategic activities aimed at launching the product or service in the market and ensuring that it meets customer needs and expectations.

A key aspect of deployment, particularly in an international context, is the availability of products in the local market.

Key aspects of the deployment process include:

- Distribution Channels: Companies determine the most effective distribution channels to reach their target market and make the product or service accessible to customers. This may involve selling through retailers, online platforms, direct sales, or partnerships with distributors.
- Implementation Support: Companies provide support and resources to help customers implement and use the product or service effectively. This may include training programs, user guides, technical support, and customer service to address any issues or questions that arise during the implementation process.
- Logistics and Fulfilment: Companies manage the logistics and fulfilment processes to ensure that the product or service is delivered to customers in a timely and efficient manner. This may involve inventory management, shipping, and order fulfilment to meet customer demand.
- Quality Assurance: Companies conduct quality assurance checks to ensure that the product or service meets performance standards, regulatory requirements, and customer expectations. This may involve testing, inspections, and certifications to verify the quality and reliability of the offering.
- Feedback and Iteration: Companies gather feedback from customers, monitor market trends, and analyse performance metrics to evaluate the success of the deployment process. Based on this feedback, companies may adjust their deployment strategies, product features, or customer support to optimize performance and drive customer satisfaction.
- Scalability and Adaptability: Companies focus on scaling up operations, expanding into new markets, or adapting the product or service to meet changing customer needs and preferences. This may involve introducing new features, updates, or enhancements to keep the offering competitive and relevant in the market.
- Regulatory Requirements: Compliance with local laws and regulations is essential for entering new markets. Companies must navigate various regulatory landscapes, including safety standards, import/export regulations, and environmental guidelines.
- Local conditions and cultural preferences: Understanding and catering to the cultural preferences and needs of the local market can significantly impact the success of a product. Customizing products to align with local behaviour as well as travel and traffic patterns can enhance acceptance and adoption.

Overall, the deployment of products and services into a market is a critical stage in the product lifecycle where companies focus on delivering value to customers, driving adoption, and building long-term relationships. By effectively deploying their offerings, companies can maximize market penetration, generate revenue, and establish a strong market presence.

2.1.4 Previous work

The *STREnGth_M* project has been preceded by *FOSTER-ROAD* (2013-2016), *FUTURE-RADAR* (2017-2020) and *FUTURE-HORIZON* (February 2021 - May 2023). The FUTURE-HORIZON project pursued the following objectives:

- Provide high-quality input for ERTRAC research roadmaps, strategic research agendas and other implementation documents.
- Assess RTR strategies in Europe, other established markets and emerging markets.
- Support capacity-building for local and national policy makers and practitioners, to generate and implement innovative sustainable mobility solutions.
- Utilize the expertise of a well-developed stakeholder network, incorporating also external advice in project outputs.
- Develop an ERTRAC dissemination strategy and communicate key ERTRAC activities and publications.

At the RTR2023 conference an additional plenary session welcomed three European organisations – AVL, Volvo Group, and TNO – to present their experience with EU funded projects over the years. They all agreed that participation in collaborative projects such as those of the H2020 research programme helps them in discovering hidden gems, in building partnerships and identifying business partners. They added that, from their perspective, the research results can constitute the first step towards successful European deployment, where standardisation is one important part. For that reason and to avoid fragmentation of standards around Europe, it is crucial to be involved in such research programmes. In the realm of road transport research, cooperation and collaboration play a pivotal role as they are key factors in driving progress in the twin transition of decarbonisation and digitalisation.

2.1.5 Related other studies

There are several other studies that provide insights into the challenges and barriers faced in the deployment of mobility and transport solutions. An extract of these conclusions are listed in the following quotes from these four articles as examples.

PHEVs: *"There are, however, barriers to PEV deployment, including the vehicle cost, the short all-electric driving range, the long battery charging time, uncertainties about battery life, the few choices of vehicle models, and the need for a charging infrastructure to support PEVs. What should industry do to improve the performance of PEVs and make them more attractive to consumers?" (see* References *R1)*

MaaS: *"Barriers and risks associated with successful implementation of Mobility-as-a-Service (MaaS) are identified. MaaS supply side barriers are lack of public private cooperation, business and political support, service coverage, vision. MaaS demand side barriers are appeal to older generations, public transport users, and private vehicle users. MaaS outcomes are reduced vehicle kilometres travelled, parking, and private vehicle ownership, and improved social equity. There is no 'one-size fit all' MaaS and consideration of local characteristics is critical for successful implementation." (see* References *R2)*

Autonomous driving: *"Research has also outlined several individual and social concerns with regard to autonomous vehicle deployment. These include the high costs induced by maintenance expenses, road user fees, and software and hardware components, rise in fuel consumption and carbon dioxide emissions resulting from increased travel demand, legal and ethical issues relating to the protection of users and pedestrians, privacy concerns and the potential for malicious hacking, safety concerns in mixed traffic situations and loss of jobs for*

alternative transportation providers. It is argued that the biggest barrier to widespread adoption of autonomous driving is psychological, not technical, in nature." (see References *R3)*

EV charging systems: *"The electric vehicle is becoming popular rapidly due to the increase of the greenhouse effect, the shift of public opinion as well as governmental support. These increasing numbers of EVs require large numbers of charging stations which consumes a huge amount of electric power and puts stress on the power grid. Most of these charging takes place in an uncoordinated manner. This uncoordinated charging causes peak demand of the grid which creates several challenges, such as increased power loss…" (see* References *R4)*

In addition, insights from the CSA project *LeMesurier (ongoing)* should also be considered going forward.

2.2 Definitions

2.2.1 Deployment

The deployment of products and services for mobility and transport solutions in Europe refers to the implementation and distribution of innovative technologies, systems, and services aimed at improving transportation air quality, safety, efficiency, sustainability, and accessibility across the continent. This can include the introduction of electric vehicles, smart transportation systems, ride-sharing platforms, logistics, public transport, and other solutions that promote decarbonised and convenient modes of mobility.

The deployment process involves planning, testing, and scaling these products and services to address the specific needs and challenges of European cities and communities. It aims to enhance the overall transportation experience, reduce congestion, lower emissions, improving air quality, improve safety and create a more connected and sustainable mobility ecosystem in Europe.

2.2.2 Challenges and Barriers

Challenges and barriers refer to the obstacles, difficulties, or limitations that can impede progress, hinder success, or prevent the achievement of goals. In the context of deploying products and services for mobility and transport solutions in Europe, challenges and barriers may include regulatory hurdles, lack of physical or digital infrastructure, funding constraints, technological limitations, resistance to change, interoperability issues, data privacy concerns, and societal acceptance.

Overcoming these challenges and barriers requires strategic planning, collaboration among stakeholders, innovative solutions, and a proactive approach to address the specific obstacles that may arise in the deployment of mobility and transport solutions in Europe. By identifying and addressing these challenges, organizations can better navigate the complexities of the transportation industry and drive positive change in the mobility sector.

2.2.3 Research Results

Research results refer to the findings and conclusions obtained through a systematic investigation or study conducted to answer a specific research question or hypothesis. These results

are typically derived from data analysis, experimentation, observation, or literature review, and they provide valuable insights, evidence, and knowledge in a particular field of study.

Research results can include quantitative data, qualitative observations, statistical analyses, trends, patterns, correlations, and any other relevant information that contributes to the understanding of a research topic. Research results may also come from demonstrations, pilots and field test activities involving end-users and stakeholders. These results are often documented in research reports, academic papers, presentations, or other forms of scholarly communication to share the findings with the scientific community and contribute to the advancement of knowledge in the respective field.

In this report the results presented at the RTR2024 conference has been in focus.

3 Results and findings

3.1 RTR2024 projects investigated.

The 7th edition of the European Conference on the Results from Road Transport Research (#RTR2024) took place from 5th to 7th February 2024 in Brussels. A total of 76 EU-funded projects were presented during 26 parallel sessions. The presentations gave the intermediate and final results from numerous Horizon 2020 projects, providing a glimpse into a promising future for road mobility.

In this report the focus has been on the projects presented on the RTR2024 conference, see appendix and the conference summary report[2] for details.

3.2 Clusters

To capture the findings from the projects presented the following cluster criteria were identified, responding to a set up questions towards the conference expert moderators and in some cases also the project coordinators. For each area an aggregated selected view from the input received is listed in the picture on next page - for each cluster.

- Technology
- Knowledge
- User involvement & Acceptance
- Eco-System & Collaboration
- Standards
- Regulation & Legislation
- Energy Infrastructure & Fuels
- Digital Infrastructure
- Physical Infrastructure
- Financial & Funding

[2] https://rtrconference.eu/wp-content/uploads/2024/04/RTR2024-Summary-Report-final.pdf

Figure 3 Ten clusters of barriers and challenges of deployment of research results

3.2.1 Technology

Technological advancements are critical for the evolution of road transport. However, several barriers impede the deployment. The guiding question is: "Are there technology challenges that need to be solved before deployment of research results is possible?" Here, we identify key barriers that must be addressed to enable the effective deployment of innovative solutions.

- Technology neutral approach to analyse and compare different challenges and possibilities in an objective manner.
- Cost competitive solutions for emerging and new solutions compared to established technologies.
- Tools and methods to be developed aligned and a need to align with competence and training.
- Safety validation of new technologies meeting standards and regulation.
- Data capturing handling, sharing and maintenance, including handling of large quantities of data and data analytics.
- Usage and application of technologies.
- Measurement methodologies and impact assessment of technologies.

Table 1 Technology challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Technology	*Are there technology challenges that need to be solved before deployment is possible?*	*- Need for technology neutral solutions for propulsion technologies, ICE and EATS technolgies (LONGRUN)* *- Need for cost competitive concepts for BEV (NextETRUCK)* *- Need to forther develop tools and methods for development and testing. (VALUE3S)* *- Safety case needs to be developed, concept to perform ODD and BC coverage analyses missing (ArchitechECA2030)* *- Handling of large quantities of data but lack of validated data quality (FRONTIER)* *- Measuring tire particles effectively and airless tires (LEON-T)* *- Lack of vehicles supporting AC V2G (INCIT-EV, SCALE)* *- Data-sharing, storage and maintenance (FAME)* *- Further development for validation of CCAM (SUNRISE)* *- Reduction of weight implementing env friendly composites, improving energy storage supercaps (LEONARDO)* *- Technology needs unknown (SOL+)* *- Lack of reports of technology needs from projects (several)* *- Technology is there, but how to utilize the technology (HEIDI, MEDIATOR)* *- Need for cost reductions (several)* *- Need to train the algorithm - more data is needed (3beLiEVe)* *- Battery technology, materials (critical raw materials), electrode processing and module design etc. (SeNSE)* *- R&D Tools and data driven methods. Scalability of tools (TANGENT)* *- Mature network of UFP measurements, database with health effects data (both toxicological and epidemiological) (nPETS)* *- Airless tyre: prototype level, development towards series quality required (LEO-T)* *- Overcoming this challenge requires innovative approaches and technologies to capture accurate data. While prototypes of airless tires show promise in reducing noise and particle emissions, further refinement is necessary to improve rolling resistance and noise levels. This may involve iterative testing and design optimization. (LEON-T)*

3.2.2 Knowledge

Knowledge dissemination and application are essential for the widespread adoption of new technologies. The guide question is: "Are there challenges/barriers related to knowledge? Knowledge gaps to be filled? Need for training, education and capacity building?" This section explores the existing barriers related to knowledge and how they can be addressed to support the implementation and deployment of research results.

- Lack of user, stakeholder and public awareness of research results.
- The importance of knowledge dissemination to increase fact-based awareness and encourage informed decision-making.
- Need for measurements of knowledge spread over time to transfer research results to support implementation and deployment.
- Important to strengthen the link to training and education. Ensuring that educational programs incorporate the latest research findings can help build a knowledgeable and skilled workforce capable of implementing new technologies.
- Lack of identification of knowledge gaps to for example direct research efforts where they are most needed.
- Need for knowledge repositories and toolboxes for knowledge sharing to facilitate access to valuable information and resources.

Table 2 Knowledge challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Knowledge	*Are there specific challenges and barriers related to knowledge? Knowledge gaps to be filled? Need for training, education and capacity building?*	*- Lack of user/public awareness of V2G related to increase battery cycling* *- Continue spread knowledge about CCAM to increase public/user/stakeholder awareness* *- Training/education/e-learning about test and vericifation of CCAM (SUNRISE)* *- Need to measure knowledge spread over time to transfer results into future implemenntation (CCAM)* *- Identifying and implementing environmentally friendly composites* *- Need to maintain and update knowledge repositories and Toolbox (FAME/SOLUTIONSplus)* *- Lack of identifying knowledge gaps (several projects)* *- Lack of forming an appropriate safety argument. Metrics and KPI as part of V&V activities, test scenarios etc. (ArchitectECA2030)* *- External HMI (HEIDI)* *- Communication between driver and vehicle (MEDIATOR)* *- Non-intrusive measure to detect fitness to drive (FITDRIVE)* *- How do we measure paticles <100nm and related toxic effects, chemistry,health effects, long-term evironmental impacts from tire emissions? (LEON-T, ULTRHAS, AeroSolfd)* *- How to measure noise impact on health? (LEON-T)* *- Studying the health effects of particle emissions, particularly as they age, presents challenges due to the qualitative shifts in toxicity responses (they are collecting data to solve this and later be able to draw conclusions) (ULTRAS)* *- Long term effects on health of ultrafine particles (TUBE)* *- How to mitigate the loss of cyclable lithium, etc. (3beLiEVe)* *- LCA analyses for CO2 emissions, fleet analyses using various powertrain systems (LONGRUN)* *- New business models to increase end-user acceptance of BEV-trucks (NextETRUCK)* *- In various cities, the limited reach of knowledge dissemination efforts highlights the need for leveraging local media and local organizations to improve outreach. Also,the development of region-specific knowledge repositories can ensure that information is tailored to local contexts and needs. (Sometimes, even country-specific would be ideal, considering the language used.) (SolutionsPlus)* *- Need for strengthened user feedback Mechanisms as High-level decisions and technologies often overlook operational and practical issues related to demand, supply, data collection, and monitoring. Gathering user feedback can highlight areas where further training, education, and capacity building are necessary. (SolutionsPlus)*

3.2.3 Standardisation

Standardisation and harmonization are crucial for deployment. The guide question is: "Is there a need for future standardisation and harmonization?" This section identifies areas where standardisation is needed to facilitate the smooth implementation of new technologies and practices.

- Identify standardisation needed for deployment, this includes everything from technical specifications to operational protocols, ensuring interoperability etc.
- Charging systems, based on operation management and best practices to enhance the availability, reliability and accessibility of charging infrastructure.
- Vehicle-2-Grid still in development, needs for standards to ensure compatibility and safety, facilitating the integration of V2G systems into existing energy infrastructures.
- Standards for “fitness to drive” is needed to ensure that drivers meet specific criteria related to health, skills, safety etc..
- Need for standards for tyre abrasion rate and airborne particle emission to help mitigate the negative impact of road transport on air quality and public health.
- Standards for retrofitting vehicles, an important point in emerging economies.

Table 3 Standardisation challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Standardisation	*Is there a need for further standardisation and harmonisation?*	*- Addressing the interplay between cybersecurity, safety and privacy (VALU3S)* *- Metrics and KPIs for ODD and BC, Safety arguments (ArchitectECA2030)* *- Charging systems. BEV truck operation and management best practices (NextETRUCK)* *- Propose practical standardised methods for tyre abrasion rate and airborne particulate emissions. Introduction of tyre-emission factors (LEON-T)* *- Clarify the need for regulation of extremely fine nanoparticles (<23 and <10 nm) and of VOC and SVOC emissions, including secondary particle precursors (ULTRHAS)* *- Rules and regulations for vehicle retrofitting with respect to exhaust emissions (AeroSolfd)* *- Fuel properties to be more harmonized (towards lower aromatics etc.). Standardised emission regulation for ultrafine particles (TUBE)* *- Aligning material reduction approaches with industry standards (SeNSE)* *- Standards for V2G still in evolution, in particular IOS 15188-20 (INCIT-EV, EV4EU, SCALE)* *- To support scaling-up and sharing best practice of e-mobility (SOLUTIONSplus)* *- Standards for retrofitting vehicles (2-wheelers, 4-wheelers) also becoming increasingly important (SOLUTIONSplus)* *- Need for standardisation needs to be defined (several)* *- Vehicle requirements for urban use (URBANIZED, Multi-MODY)* *- Consistent legislation in different countries for goods transport. (FITDRIVE)* *- Standardisation is needed on fitness to drive: define quantification method and admissible levels. (FITDRIVE)* *- Protocols for measuring the UFP number concentrations, sampling on filters, and using the ALI (Air Liquid Interface) system in field and laboratory toxicology studie (nPETS)*

3.2.4 Eco-System

The eco-system for deployment of mobility solutions is increasingly important as vehicles are becoming more integrated in the overall transport system. The guide question is “Is the R&I eco-system missing involvement of stakeholders?”. This section lists the input from a number of projects regarding the need for increased stakeholder involvement.

- Missing alignment with the broader eco-system goals.
- Compatibility between different transport modes.
- How to ensure that all relevant stakeholders are involved?
- Need to identify if stakeholders are missing.
- How to integrate missing stakeholders?
- Involvement of investors for funding and scalability.
- Balancing the involvement of stakeholders based on funding.
- Need to develop and grow eco-systems for ZEV fleets including infrastructure development, policy support, and market readiness.
- Need for coordinated efforts from multiple stakeholders.
- Involvement of insurance companies to help address concerns related to liability, safety, and financial risks associated with new technologies.

Table 4 Eco-system challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
ECO-System	*Is the R&I eco-system missing involvement of stakeholders?*	*- Alignment with broader ecosystem goals (TANGENT)* *- Compatibility with diverse transport modes (TANGENT)* *- Integrating the impact of fuel properties on emissions and reducing aromatic content in fuels into existing fuel production and distribution ecosystems. (TUBE)* *- Integrating the developed technologies into the broader battery ecosystem. (SENSE)* *- uncertain if all the relevant stakeholders are involved (LEONARDO, REFLECTIVE, URBANIZED)* *- Sufficient involvement of investors like WorldBank? (SOLUTIONSplus)* *- Need for defining whether key stakeholders are missing. Other groups of stakeholders may lack the information and knowledge to engage effectively in R&I activities. This can result in their exclusion from important discussions and decision-making processes (SOLUTIONSplus)* *- Balanced involvement of stakeholders in projects based on funding? (Multi-Moby)* *- Need to develop the eco-system for BEV truck fleets involving city authorities, fleet operators, logistics providers, drivers, fleet management, etc. (NextETRUCK)* *- Involvement of insurance companies related to risk evaluation of ADS (ArchitectECA2030)*

3.2.5 User Involvement & Acceptance

The success of research and innovation projects often hinges on the involvement and acceptance of end-users. The guiding question for this cluster is: "Are the end-users of the research results engaged? How about user acceptance?" Below, we explore the barriers and strategies related to user involvement and acceptance.

- Users, stakeholders and companies understanding of the need for simulations and optimisation models in the development and deployment of new technologies and services.
- Limited involvement of end-users in the early stages of R&I which can result in solutions that do not fully address user needs or preferences, leading to lower acceptance rates.
- Importance of end-user involvement.
- Lacking effective methods for user involvement.
- The importance of large-scale demonstrations and pilots to enable user involvement and user acceptance.
- Lack of vehicles and fleets available for users to test and experience solutions.
- Need to involve different end-users since there is a large diversity in user groups.
- Need to increase the end-user community.
- More sites, more test cases, more locations and geographic spread.
- Risk acceptance of end-users when testing new solutions (e.g. AD)

Table 5 User involvement & acceptance challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
User Involvement	*Are the end-users of the results engaged? User acceptance?*	*- Does users/companies understand the need for simulation/optimization models? (PLANET)* *- Limited involvemment of end-users (INCIT-EV)* *- User surveys related to V2G etc. (EV4EU)* *- Public involvement shows different levels of acceptance of V2G (SCALE)* *- Good involvement but continously important (Several)* *- Pilots have been initiated to test user acceptance, high-quality user surveys and recommended (LEONARDO)* *- Usage plans for some sites (REFLECTIVE)* *- Suppose to support user involvement (SOLUTIONSplus)* *- Some usage plans for bpost (URBANIZED)* *- Lacking actual fleet and road testing? (Mulit-Moby)* *- Need to involve different end-users (NextETRUCK)* *- Need to increase the end-user community. Further dissemination needed, public web repositories (VALUE3S)* *- Risk acceptance criteria where the entire value chain and user should be involved to assess the impact of the deployed ADS properly. (ArchitechtECA2030)* *- Limited scale with few test cases and locations (several)* *- Yes users included (AeroSolfd=*

3.2.6 Regulation & Legislation

Regulation and legislation can enable and even drive deployment of research results but could also be regarded as a barrier. The guide question is “Are there regulatory barriers that needs to be overcome?” Listed below is the input from projects.

- Need for recommendations related to data sharing, governance and privacy. As technologies advance, especially those related to connected and automated vehicles, establishing guidelines for how data should be managed, shared, and protected is crucial to ensure compliance and trust.
- Lack of alignment and harmonisation of national, EU and international regulations in many areas (e.g. testing of Automated Vehicles, Vehicle-to-Grid) making cross-border cooperation and deployment more challenging.
- Lacking regulations in specific areas (e.g. ultrafine particles emissions) can hinder the development and adoption of innovations intended to mitigate issues such as air pollution.
- Lack of harmonised regulations for vehicle testing.
- Inconsistent testing standards and procedures across different international regions.
- Conformance between different regulation areas (e.g. health)
- Regulations open for interpretations.
- Alignment of regulation/legislation with incentives.
- Timing of introduction of regulations.
- Varying levels of regulatory development.

Table 6 Regulation & legislation challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Regulation	*Are there regulatory barriers that needs to be overcome?*	*- Recommendations on the topic related to data sharing, governance and GDPR (TANGENT, FAME)* *- Meet WHO recommendations, Not yet provision of air quality guidelines for atmospheric UFP particle concentrations (nPETS)* *- Regulating ultrafine particles and assessing factors driving toxicity and health effects (LEON-T)* *- Clarify the need for regulation of extremely fine nanoparticles (<23 and <10 nm) and of VOC and SVOC emissions, including secondary particle precursors (ULTRHAS)* *- No, but maybe: responsibilities of compliance regarding the original vehicle homologation and safety (AeroSolfd)* *- More effort should be put on characterization of semivolatile emissions – UFP health hazards, including characterization of compounds (TUBE)* *- Aligning project outcomes with existing or evolving battery technology regulations (SeNSE)* *- Legal matters bottleneck in enabling machinedriven concepts sych as synchromodality and Physical Internet (PLANET)* *- Harmonisation of member states’ V2G regulations (User Centric Charging solutions)* *- Adopt pan-European regulation at local level for micro-vehicles (LEONARDO)* *- Approving the automated driving system for optimal positioning of the wireless charging plates (REFLECTIVE)* *- Assess the ability and potential impact of the tool box by the regulators (SOLUTIONSPLus)* *- Varying levels of regulatory development (SOLUTIONSPLus)* *- Assess the Urban Logistics Digital Twin with a block specifically for city dynamics, Acceptance of intelligent algortitms, speed of regulation change for LCV (URBANIZED)* *- Autonomous-capable vehicles and road testing (Multi-Moby)* *- Regulation of VECTO+, Eco-bonus and baseline (LONGRUN)* *- Incentives for urban ZEV logistics (NextETRUCK)* *- Need to conform to the health regulations. Many of the forthcoming regulations, particularly in the field of cybersecurity, safety of machinery and AI, may include such barriers. (VALUE3S)* *- The EU ADS regulation is an open regulation meaning open for interpretation which means the OEM has to come up with an appropriate convincing safety argument to get the vehicle homologated by the corresponding type approval authority. This approach is not scalable and therefore not suitable for ADS update, ODD enlargements, etc. (ArchitectECA2030)* *- Consistent regulations on a global scale in order to handle external HMI implementation efficiently (HEIDI)*

3.2.7 Energy infrastructure & Fuels

The deployment of innovative transportation solutions such as BEVs and other low-emission technologies largely depends on the availability of robust energy infrastructure and fuels. The guiding question for this section is: "Is there a lack of specific energy infrastructure to be available before deployment? " Below, we outline the barriers related to energy infrastructure and fuels.

- Lack of charging infrastructures for BEVs
- Very high prices for electrical energy at existing charging stations
- Lack of electric grid power along transport routes, in particular for HCV
- Lack of supply of renewable electricity
- Slow and complex tender process for establishing charging infrastructure.
- Scaling of local implementation to large harmonised regions, nationally and internationally
- Lack of availability of renewable fuels (Hydrogen, HVO, Methanol, Methane, etc.)
- Energy infrastructure and availability of fuels varies between international regions.

Table 7 Energy infrastructure & Fuels challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Energy infrastructure & Fuels	*Is there a lack of specific energy infrastructure to be available before deployment? (e.g. Electric grid, Hydrogen => be specific)*	*- Electric grid, Charging infra. Both slow and fast, Smart charging, ERS, Bi-directional, Depot charging, ...* *- Usage models for energy and power, both private and shared* *- Tender process for charging infra is still on traditional AC charging* *- Local implementation needs to exand to large harmonised areas/region/national/international* *- Need for eco-charging* *- Availability of alternative renewable fuels for HDV applications (HVO, Methanol, Hydrogen, Methane, etc.)* *- Development methodologies of new products & services needs also to consider energy infrastructure is not considered.* *- Reduced aromatics in liquid fuels.* *- Lack of renewable energy is particularly crucial in densely populated cities or areas with unreliable power supply. (SolutionsPLus)* *- Market and economic constraints, as developing extensive energy infrastructure varies between regions. (Market conditions, funding availability, and economic priorities can all influence the pace and scale of infrastructure deployment.)(SolutionsPLus)*

3.2.8 Digital Infrastructure

The digital infrastructure is increasingly important to consider deploying research results. The guide question “Are there specific need to further develop and deploy digital infrastructure (e.g. Cloud services, Connectivity coverage)” The following barriers and challenges have been identified.

- Need for common dataspaces to exchange information.
- Need for collect, share and use high-quality, diverse and GDPR compliant data.
- Robust and resilient digital infrastructures for real-time information
- Digital solutions for air quality data monitoring and health prediction
- Sharing of IOT data
- Large investment needs and operational costs for digital infrastructure,
- Digital twins depending on reliable digital infrastructures.

Table 8 Digital infrastructure challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Digital Infrastructure	*Are there specific need to further develop and deploy digital infrastructure (e.g. Cloud services, Connectivity coverage)*	*- Yes, common data spaces to exchange information between different mounts and gov areas. Need to collect and use high-quality, diverse and GDPR-compliant data. Need for real-time data sharing facilitate: coordination and sync between transport modes and problem solving of forcasted and unplanned situations. (ORCHESTRA)* *- Challenges may include ensuring robust digital infrastructure for real-time information services and data sharing (TANGENT)* *- Digital solution for air quality monitoring and health impact prediction (nPETS, ULTRHAS)* *- install network of UFP sensors (nPETS)* *- Challenging to share IOT device data (data ownership, GDPR issues when it comes to haviglocations available of barges for ex. (ePlcenter)* *- Battery sharing App has been developed - most likely no need for additional infrastructure unless a massive rollout is planned (not currently planned) (LEONARDO)* *- The digital infrastructure may be a weakness in the developing regions due to investment needs (SOLUTIONSplus)* *- The urban Logistics Digital Twin (especially the Intelligent Algorithms) may be dependent on a reliable digital infrastructure.(URBANIZED)x* *- Especially scenario databases needed to be fed by identified critical scenarios out of the in-service monitoring activities (see pillar III of the EU ADS regulation). (ArchitectECA2030)* *- Maybe, to complement the physical HMI (HEIDI)* *- Digital infrastucture could provide additional information and support (MEDIATOR)* *- In the international cases whereby the lack of investment results in limited connectivey, outdated technology and inadequate support systems that impede the adoption and deployment of modern digital solutions. (SolutionsPlus)* *- Need for more diverse stakeholder involvement and capacity building (SolutionsPlus).*

3.2.9 Physical Infrastructure

The physical infrastructure may also be considered when identifying barriers and challenges for deployment of research results. The guide question for this section has been “Are there specific need to further develop and deploy digital infrastructure (e.g. Cloud services, Connectivity coverage)”. The following barriers and challenges have been identified.

- Adapting optimised physical infrastructures to reduce particle emissions.
- Need for space for charging stations.
- Maintenance of physical infrastructures.
- Adaptation and investment needs for electric road systems.
- Potential need to adapt road network for automation.

Table 9 Physical infrastructure challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Physical Infrastructure	*Is there a need to further develop the physical infrastructure (e.g. Road, Parking, intermodal hubs)*	*- Road: optimize road surface for reduced particle creation and for particle capture (LEON-T)* *- Set up stationary filters in hotspots (e.g. in subway stations) to clean the air as demonstrated in the project (AeroSolfd)* *- Adapting physical infrastructure to mitigate particle emissions and their health impacts.* *- Adapting physical infrastructure for the production and integration of new battery technologies.(SeNSE)* *- Wireless ERS not available yet (INCIT-EV)* *- DSOs must allow V2G services by connected EVs. (EV4EU)* *- Municipalities must tender public charging infrastructure with V2G (SCALE)* *- Building up the physical charging stations would be necessary, but not expected to be a major challenge - possible complications with the local urban management services (LEONARDO)* *- There is no need to build up specific physical charging stations since existing stations should be also usable for these vehicles. However wireless charging could require substantial investments depending on the use for on-street parking or private parking. It is unclear if the vehicles are intended to be integrated into a sharing system - this would significantly impact the cost for the wireless option. (REFLECTIVE)* *- The intention of SOLUTIONSplus is to support capacity building - no specific details are available on true challenges for infrastructure especially since the project is involved in so many different regions and the criteria for selecting the regions is unclear. The barriers may be that investors may have other priorities.* *- Possibly, the physical infrastructure is an important part of the system (HEIDI)*

3.2.10 Financial & Funding

Financing and funding are finally of central importance to enable deployment of research results. The guide question here has been “Is there a need for further investments, incentives, cost reduction etc?”. The following barriers and challenges have been identified.

- More funding for R&I needed to support the green transition.
- Cost-benefits analyses including TCO and LCA.
- Investments and operational costs for infrastructures.
- Incentives to stimulate uptake and use.
- Pricing schemes and subsidies for making technologies more accessible and attractive to a broader market.

Table 10 Financial & Funding challenges and barriers

Challenges and barriers for deployment		Aggregated selected view
Financial & Funding	*Is there a need for further investments, incentives, cost reduction etc?*	*- High data collection cost (DIT4TraM)* *- The mention of being a consortium and the need for extensive data collection suggests potential resource requirements. (TANGENT)* *- A Cost Benefit study is expected at the end of the project (nPETS)* *- Next steps of research recommended (several)* *- More effort should be put on characterization of semivolatile UFP health hazards, including characterization of compounds (TUBE)* *- Second life for batteries depends on the 2nd life application configuration and the repurposing effort. Absent Co, economics of recycling process are difficult (revenue-cost=+/-0) (3beLiEVe)* *- The stimated cost for wireless ERS is € 6-10 m per km highway (INCIT-EV)* *- Pricing schemes penalising long connection to charging points are prohibitive to smart charging and V2G.* *- Financial benefits would incentivise users to participate in V2G as well in V1G (SCALE)* *- Major rollout will require some resources (to build up a substanial fleet) - potential investors will want to see/assess both RoI and risk plan appropriately addressed (several)* *- This should be the core of ambition for SOLUTIONSplus. How to make startups attractive for investors - no information is directly avalible here* *- more public funding needed for coach development (LONGRUN)* *- TCO Calculations and models,* *- Incentives for BEV trucks / vehicles* *- new business models to increase end-user acceptance and foster the market uptake of the project solutions.* *- There is rather the need for further collaborative research to bring the topics even to the next levels, for instance by incorporating AI much more. (VALUE3S)* *- Yes, definitely, new projects and R&I initiatives are asked to build on existing results across several projects to identify the current white spots and gaps to be prioritized and closed in an efficient manner. Especially the two domains ADS and AI should bundle their strengths to make the next step together as the show different strengths and weaknesses to be combined in a smart manner. (ArchitectECA2030)*

4 Conclusions and Recommendations

The task presented in this deliverable has focused on the identification of barriers and challenges for the deployment of research results from different perspectives. These could be both from a development phase perspective and from a system context perspective of developing, implementing and deploying transport solutions. The analyses has been based on the ongoing and completed projects presented at the RTR2024 conference.

In general, the projects have identified barriers and challenges mapped according to the 10 different clusters as described in this document. There are opportunities to address these barriers and challenges listed in the recommendations below.

The process perspective considers where there is a challenge to transfer research results to be acknowledged and taken into consideration in later stages of development. Research and advanced engineering projects should be early in the process paving the way for innovation and future development of products and services. Transferring research results requires specific attention and it is important to really consider how to ensure this critical phase. Depending on the topic of the research results different methods needs to be considered.

Naturally the transfer of research results is a two-way dialogue between the users and the research community and provide considerable opportunities for learnings, further insights.

- **How**, what is the most suitable method for transfer results. Demonstration, pilots, reports, conferences, etc.?
- **When**, what is the best timing of transferring results ?
- **What**, considering confidentiality, competition compliance, etc.
- **Who,** to whom should the transfer be done, who is best suited etc.

Ten clusters have been identified based on the review of a selection of projects presented at the RTR2024 research results conference. These clusters cover various aspects from, Technology, Knowledge, User involvement, Eco-system, Standards, Regulations, Infrastructures and finally Financial & Funding. For each cluster different barriers and challenges for deployment have been identified, that will require focused attention to ensure the continued progress and successful deployment of innovative road transport solutions.

The following recommendations have been identified.

- **Continued focus on R&I technology**. Technology innovation drives the potential of new solutions to meet the demands for the digital and green transition of the road transport system. It is also vital to strengthen and enhance the competitivities of Europe where technology innovation is a key enabler. Specifically, R&I funding needs to be made available to research solutions that are more cost effective, sustainable and require less energy throughout their life cycle.
- **Improve the knowledge transfer of research results**. It is very important to ensure transferring results of research results, not only in new projects. Demonstration and

pilots are efficient methods to further explain and disseminate results for the next phases in the development chain. Training, education and various using different forms of knowledge transfer needs to be further enhanced. Base research activities should already be made in cooperation with industry, in order to start training phase of new skilled people and researchers and introduce the relevance for the society as early as possible.

- **Increase user involvement and user dialogue**. It is of key importance to continue and strengthen the dialogue with the users of the solutions. This should ideally be a two-way dialogue to increase the understanding of user needs and to disseminate the results of research projects together with the users. Demonstrating results plays one important role to stimulate this dialogue.

- **Broaden the stakeholder eco-system engagement**. The digital and green transition of the road transport system gets increasingly integrated. New stakeholders continuously enter the eco-system as vehicles and infrastructure gets more integrated and new technology and knowledge emerges. It is important to have an open approach to welcome new stakeholders into research projects to broaden the community.

- **Ensure continued link to standardisation**. The European R&I projects provide a strong base to European and international standardisation. It is important that the projects test new solutions and engage different stakeholders to come together with common harmonised solutions.

- **Strengthen the link to regulation.** The regulatory framework plays a key role in deployment of solutions of road transport research results. There is an existing dialogue with the regulatory bodies, but it is important to strengthen this link further as new results and solutions emerge. This is particularly important in areas related to services and data and in cross-sector areas. Regulation can be a driver for the introduction of new technologies, especially when it acts on the end user, who needs to follow the rules without being restricted in their freedom.

- **Continue involvement with physical infrastructure.** There is a strong involvement with the road infrastructure stakeholders in the projects. It is important to continue the involvement and ensure a sound dialogue between the vehicle and road infrastructure stakeholders to enable understanding of needs and opportunities for further research and deployment of research results.

- **Improve the collaboration with energy infrastructure**. In the green transition of the road transport system the energy infrastructure stakeholders play an increasingly important role. The electric grid and charging infrastructure and hydrogen and renewable fuels is particularly important.

- **Strengthen digital infrastructures: Services & Data.** Future road transport solutions are increasingly depending on the digital infrastructure. Connectivity, Cloud, Services, AI, etc. opens for considerable opportunities for further research and innovation. Hence it is of key importance to further strengthen the involvement of this sector in future research and innovation to enhance deployment of research results.

- **Improve the funding schemes to support the digital and green transition – with focus on deployment of new technologies and the removal of the barriers.** Finally, the transition of the road transport system will require significant financial support to strengthen the European road transport community and stakeholders, in the clusters identified in this report to **increase industrial actors' engagement.**
    - **Speed up the whole process** that precedes the start of EU research projects, from drafting calls for proposals to the completion of the grant agreement preparation phase, to make it easier for research projects to effectively address current challenges.
    - **Have more focus on call topic descriptions to make sure that significant progress can be made in these focus areas**, rather than little incremental improvements in a broad range of research aspects that do not encourage deployment in the end.
    - While ambition is important, **have a stronger focus on the realism of project objectives the evaluation phase of project proposals**, as project objectives that are ambitious, but not realistic to achieve, will not result in deployment.
    - Consider to a larger extent **the capability of project consortia to finally deploy project results** in the evaluation phase of project proposals.

5 References

R1. Overcoming Barriers to Deployment of Plug-in Electric Vehicles, Overcoming Barriers to Deployment of Plug-in Electric Vehicles

R2. Barriers and risks of Mobility-as-a-Service (MaaS) adoption in cities: A systematic review of the literature

R3. What drives the acceptance of autonomous driving? An investigation of acceptance factors from an end-user's perspective" by Nastjuk, Herrenkind, Marrone, Brendel and Kolbe.

R4. Global challenges of electric vehicle charging systems and its future prospects: A review" by Mahmud, Medha et al.

6 Appendix

6.1 RTR2024 projects

Project Acronym	Project Title
DIT4TraM	Distributed Intelligence and Technology for Traffic and Mobility Management
FRONTIER	Next generation traffic management for empowering CAVs integration, cross-stakeholders collaboration and proactive multi-modal network optimization
ORCHESTRA	Coordinating and synchronising multimodal transport improving road, rail, water and air transport through increased automation and user involvement
TANGENT	ENHANCED DATA PROCESSING TECHNIQUES FOR DYNAMIC MANAGEMENT OF MULTIMODAL TRAFFIC
nPETS	NANOPARTICLE EMISSIONS FROM THE TRANSPORT SECTOR: HEALTH AND POLICY IMPACTS
LEON-T	Low particle Emissions and lOw Noise Tyres
ULTRHAS	ULtrafine particles from TRansportation – Health Assessment of Sources
AeroSolfd	Fast track to cleaner, healthier urban Aerosols by market ready Solutions of retrofit Filtration Devices for tailpipe, brake systems and closed environments
TUBE	Transport derived Ultrafines and the Brain Effects
3beLiEVe	Delivering the 3b generation of LNMO cells for the xEV market of 2025 and beyond
SeNSE	Lithium-ion battery with silicon anode, nickel-rich cathode and in-cell sensor for electric vehicles
COBRA	CObalt-free Batteries for FutuRe Automotive Applications
IntelLiGent	Innovative and Sustainable High Voltage Li-ion Cells for Next Generation (EV) Batteries
PLANET	Progress towards Federated Logistics Through The Integration Of TEN-T into A Global Trade Network

ePIcenter	Enhanced Physical Internet-Compatible Earth-frieNdly freight Transportation answER
STORM	Smart freight TranspOrt and logistics Research Methodologies
FOR-FREIGHT	Flexible, multi-mOdal and Robust FREIGHt Transport
INCIT-EV	Large demonstratIoN of user CentrIc urban and long-range charging solutions to boosT an engaging deployment of Electric Vehicles in Europe
EV4EU	Electric Vehicles Management for carbon neutrality in Europe
SCALE	SCALE - Smart Charging ALignment for Europe
FAME	Framework for coordination of Automated Mobility in Europe
SUNRISE	Safety assUraNce fRamework for connected, automated mobIlity SystEms
SINFONICA	Social INnovation to FOster iNclusIve Cooperative, connected and Automated mobility
Move2CCAM	MethOds and tools for comprehensive impact Assessment of the CCAM solutions for passengers and goods
LEONARDO	MicrovehicLE fOr staNd-Alone and shaReD mObility
REFLECTIVE	RECONFIGURABLE LIGHT ELECTRIC VEHICLE
SOLUTIONSplus	Integrated Urban Electric Mobility Solutions in the Context of the Paris Agreement, the Sustainable Development Goals and the New Urban Agenda
PoDIUM	PDI connectivity and cooperation enablers building trust and sustainability for CCAM
AUGMENTED CCAM	Augmenting and Evaluating the Physical and Digital Infrastructure for CCAM deployment
MobiDataLab	Labs for prototyping future Mobility Data sharing cloud solutions
MORELife	Material, Operating strategy and REliability optimisation for LIFEtime improvements in heavy duty trucks
IMMORTAL	IMproved lifetiMe stacks fOR heavy duty Trucks through ultrA-durabLe components
StasHH	Standard-Sized Heavy-duty Hydrogen
URBANIZED	modUlaR and flexible solutions for urBAN-sIzed Zero-Emissions last-mile Delivery and services vehicles
Multi-Moby	Safe, Secure, High Performing Multi-Passanger and Multi-Commercial Uses Affordable EVs
5GCroCo	Fifth Generation Cross-Border Control
5G Carmen	5G for Connected and Automated Road Mobility in the European UnioN
5GMOBIX	5G for cooperative & connected automated MOBIlity on X-border corridors
PRHYDE	Protocol for heavy duty hydrogen refuelling
H2Haul	Hydrogen fuel cell trucks for heavy-duty, zero emission logistics
DEFACTO	Battery DEsign and manuFACTuring Optimization through multiphysic modelling
MODALIS2	MODelling of Advanced LI Storage Systems
LONGRUN	Development of efficient and environmental friendly LONG distance powertrain for heavy dUty trucks aNd coaches

NextETRUCK	Efficient and affordable Zero Emission logistics through NEXT generation Electric TRUCKs
VALU3S	Verification and Validation of Automated Systems' Safety and Security
ArchitectECA2030	Trustable architectures with acceptable residual risk for the electric, connected and automated cars
ASTRABAT	All Solid-sTate Reliable BATtery for 2025
SAFELiMOVE	advanced all Solid stAte saFE LIthium Metal technology tOwards Vehicle Electrification
SOLiDIFY	Liquid-Processed Solid-State Li-metal Battery: development of upscale materials, processes and architectures
SALIENT	Novel Concepts for Safer, Lighter, Circular and Smarter Vehicle Structure Design for Enhanced Crashworthiness and Higher Compatibility
V4SAFETY	Vehicles and VRU Virtual eValuation of Road Safety
SAFE-UP	proactive SAFEty systems and tools for a constantly UPgrading road environment
CONNECT	Continuous and Efficient Cooperative Trust Management for Resilient CCAM
SELFY	SELF assessment, protection & healing tools for a trustworthY and resilient CCAM
EVENTS	ReliablE in-Vehicle pErception and decisioN-making in complex environmenTal conditionS
MOVE21	Multimodal and interconnected hubs for freight and passenger transport contributing to a zero emission 21st century
SCALE-UP	Scale up user-Centric and dAta driven soLutions for connEcted Urban Poles
LEAD	Low-Emission Adaptive last mile logistics supporting 'on Demand economy' through digital twins
ULaaDS	Urban Logistics as an on Demand Service
SHOW	SHared automation Operating models for Worldwide adoption
AWARD	All Weather Autonomous Real logistics operations and Demonstrations
Hi-Drive	Addressing challenges toward the deployment of higher automation
PowerDrive	Power electronics optimisation for next generation electric vehicle components
RHODaS	Reinventing High-performance pOwer converters for heavy-Duty electric trAnSport
HiPE	High Performance Power Electronics Integrations
HEIDI	Holistic and adaptivE Interface Design for human-technology Interactions
MEDIATOR	MEdiating between Driver and Intelligent Automated Transport systems on Our Roads
FITDRIVE	Monitoring devices for overall FITness of Drivers
REVOLUTION	Supporting the Electric Vehicle REVOLUTION through maximising EV Range and End-of-Life Vehicle Recovery through optimisation of recycled plastics and advanced light materials
ALMA	Advanced Light MAterials and processes for the eco-design of electric vehicles
Fatigue4Light	Fatigue modelling and fast testing methodologies to optimize part design and to boost lightweight materials deployment in chassis parts

HighScape	High efficiency, high power density, cost effective, scalable and modular power electronics and control solutions for electric vehicles
PROGRESSUS	Highly efficient and trustworthy electronics, components and systems for the next generation energy supply infrastructure
HADRIAN	Holistic Approach for Driver Role Integration and Automation Allocation for European Mobility Needs
NextPerception	Advanced sensing technologies for the health and automotive sectors
NEMO	Noise and Emissions Monitoring and radical mitigation
LENS	L-vehicles Emissions and Noise mitigation Solutions