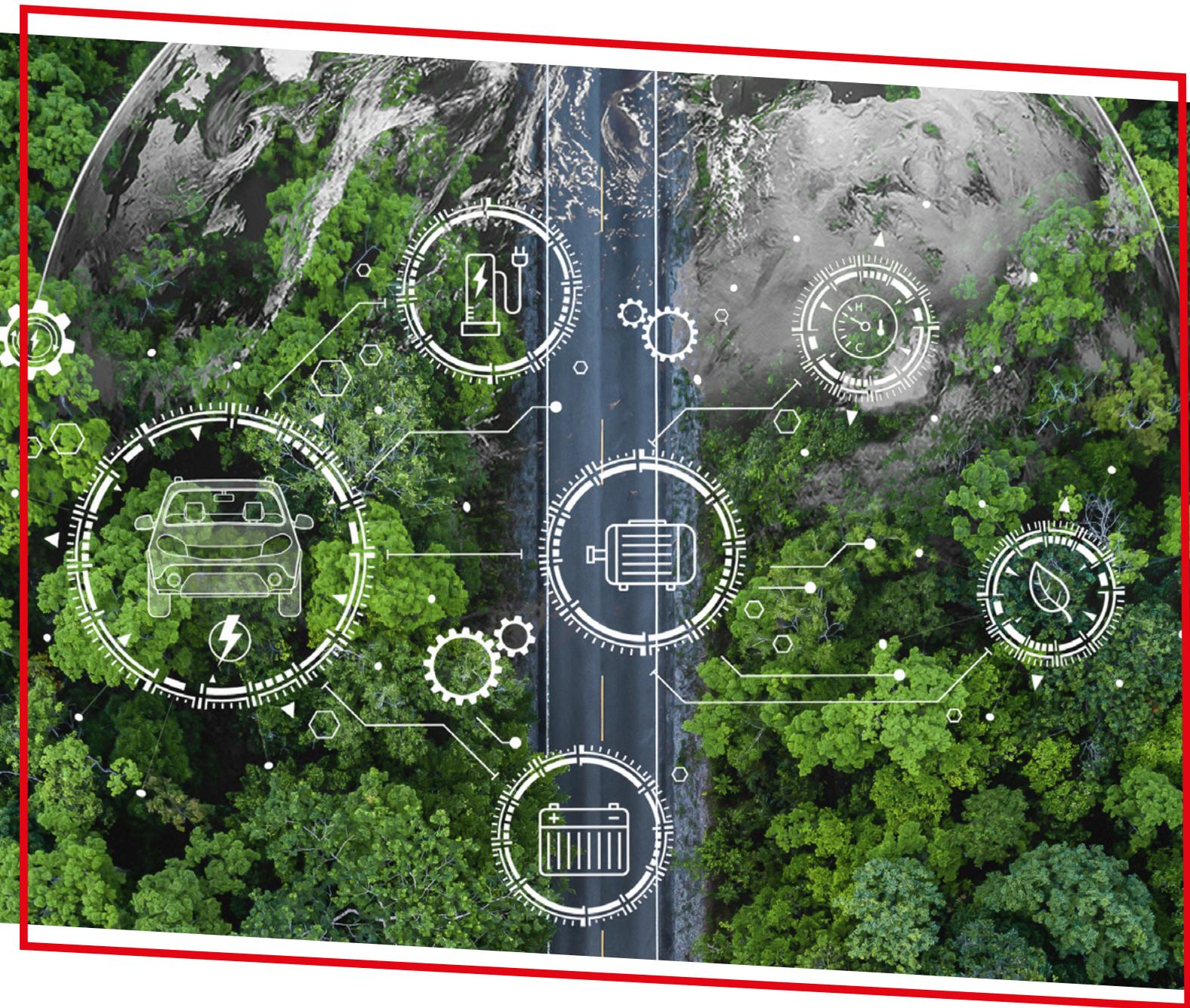




EARPA High-level Position Paper 2023



**EUROPEAN AUTOMOTIVE
RESEARCH PARTNERS ASSOCIATION**



Preface

EARPA, the European Automotive Research Partners Association, is continuously looking at how research in road mobility can help mitigate risks and improve Europe's future, achieving a positive impact on the world.

The road transport system cannot be considered a system on its own. It is part of a larger system and has significant interactions with other (sub)systems. Challenges of other industries and transport modes, as well as their innovations, have an impact on the road transport system and vice versa. Societal aspects must be included in order for technical solutions to be accepted by society and users.

Against this background, EARPA's research activities must take a wide-ranging approach that considers the interfaces of road transport research with other transport modes, the energy sector, manufacturing industry, raw material sourcing and society with an unprecedented intensity.

This high-level position paper seeks to highlight the aspects that will be considered by the EARPA Foresight Groups, to make suggestions for forthcoming European Research Programmes and to be at the heart of our members' future R&I activities.

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Executive Summary

The Horizon Europe Framework Programme, like its predecessor Horizon 2020, offers Europe a great opportunity to positively respond to the Global Challenges as defined by the European Commission, as well as to the UN Sustainable Development Goals.

The positions expressed in this High-Level Position Paper show how the members of EARPA have identified key research themes, in relation to the main challenges and drivers for resilient transport and mobility, for people and goods.

In addition, broader issues related to research and innovation in Europe in general are raised. EARPA and its members look forward to a continued, successful, European wide collaboration in the research arena of road transport to help establish a system approach, contributing to a systemic, sustainable transformation of the European road mobility arena.

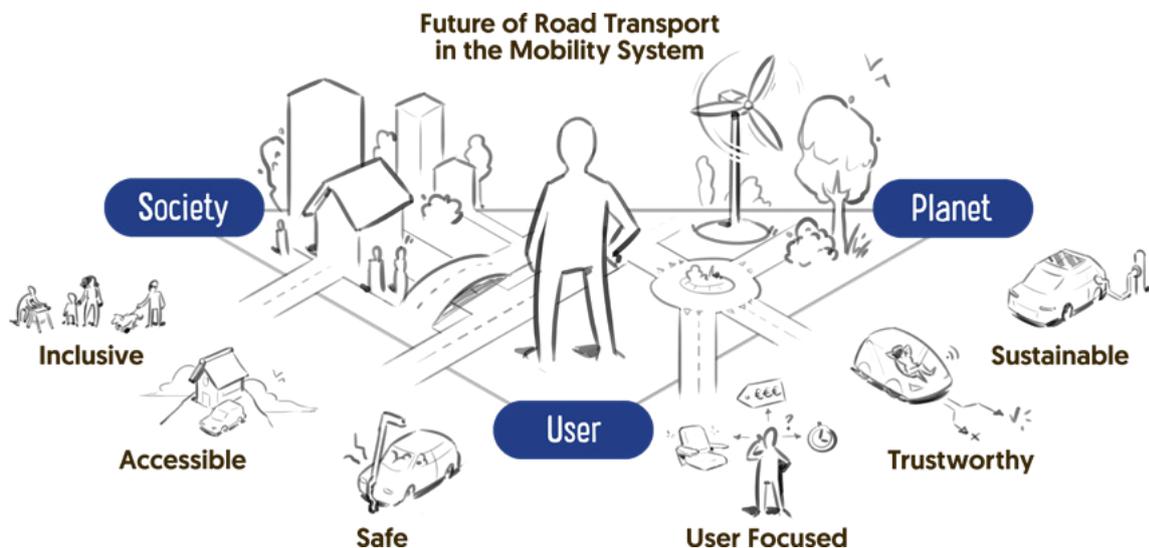
While current challenges and trends are likely to affect how people and goods will be moved in Europe in future, disruptive events show that the future will not necessarily be an extrapolation of the past.

EARPA's high-level recommendations for upcoming Framework Programmes include:

- While European transport policy needs to stay closely aligned with climate and energy policy, mobility is a fundamental need of EU citizens. Research under upcoming Framework Programmes should pave the way towards a future European road

transport system that will be sustainable, safe, accessible, inclusive, user-focussed and trustworthy.

- Social and economic sustainability are important dimensions of sustainability in addition to its ecological dimension. Research for higher levels of safety, accessibility and inclusiveness of the road transport system can make important, direct contributions to social and economic sustainability and should be strengthened significantly. The ongoing digitalisation should be used as an accelerator.
- Beyond net-zero tailpipe emissions, other factors along the full life cycle of vehicles and infrastructure are increasingly important in light of the ecological sustainability of the road transport system. European resource sovereignty is more and more a critical issue. Research should effectively support the transition to circularity and resource efficiency in the road transport industry.
- Lower transport volumes could ease many challenges for the European road transport system. Approaches to decouple personal freedom and economic prosperity from transport volumes should be included in EU road transport research.
- In times of crises and disruptive changes, resilience is a crucial property of all systems satisfying EU citizens' basic needs. The need for resilient solutions should be embedded in all future EU road transport research activities.



Introduction

Europe is facing a multitude of challenges in relation to its road transport system. These challenges relate to resource (including energy, materials and skills) security and availability, climate change and other environmental issues, plus road safety.

The need for resilience in view of disruptive events (including COVID-19 and political instability), consideration of social and demographic changes, and for increased European competitiveness, bring further challenges to our transport and mobility system.

These factors are challenging the way we consider mobility, and they challenge the transition towards a more sustainable mobility system in an increasingly digitalised society.

The United Nations Sustainable Development Goals (SDG)¹ show a shared, global responsibility for us all towards a better and more sustainable future for our planet. They are the blueprint to achieve a better and more sustainable future for our planet.

Road mobility is an important facilitator to several of these Sustainable Development Goals, including (9) Industry, Innovation and Infrastructure; (11) Sustainable Cities and Communities; and (13) Climate Action.

EARPA sees working with a system approach as an essential and powerful option to deal with these interrelated challenges to meet the SDGs.

Such a system approach entails single technologies as well as non-technological solutions contributing to the overarching aim: a sustainable future for all.

¹ <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>





European transport and mobility landscape

Challenges such as **global warming, demographic changes or socio-economic transformations** through new technologies, e.g., **digitalisation or artificial intelligence**, are affecting every aspect of our daily lives.

Traditional concepts of economic prosperity and social stability are based on continued material growth and intensive use of limited natural reserves. This is accompanied by ever-increasing transport of people and goods.

Furthermore, our globalised society has become more sensitive to disruptions such as pandemics and other man-made or natural events causing economic and humanitarian crises. Societies in different regions of the world respond differently to global challenges and such disruptive events.

The conventional approach to fighting soaring debt, export marginalisation and energy crisis is to prioritise economic growth at the expense of climate action. With the Green Deal, Europe has chosen a different approach. It can be seen as an important step in the direction of generating economic and societal benefits from the advancement of environmental sustainability.

However, fighting climate change and using natural resources sustainably should be understood globally, not just in Europe, as a chance for economic prosperity as an alternative to traditional concepts.

Urbanisation can follow very different local trends. While it may well accelerate in the coming years, in some areas, including in Europe, this trend **could reverse** in the coming decades.

Digitalisation and automated driving will enable on-demand, tailored mobility concepts (also in rural areas) as well as changes in working conditions (e.g., extended home office). These technological trends can have further, yet unforeseen effects, enabling moving back to rural areas or at least to the urban fringe (peri-urban).

Other developments, such as the shift from local retail to e-commerce, may further add to this by increasing the attractiveness of business locations other than city centres.

At the same time, globalisation has been driving localisation on different levels, within the EU as well as within Member States. This may facilitate mobility solutions to be tailored to regional and behavioural particularities, but it can also challenge **seamless mobility solutions**.

The informal introduction of new regional borders by regional actors taking divergent approaches to solving local challenges must definitively be avoided.

Data handling is another important area. Because society in Europe highly values data



protection, the EU has put strict regulations in place with the General Data Protection Regulation (GDPR).

Global competitors show different attitudes to such individual rights. At the same time, great value is seen in mobility data. The ability to exploit them is becoming an important competitive advantage for Europe's global competitors with the risk of Europe falling behind.

This is aggravated by the enormous monetary and technological capabilities of actors in other parts of the world. Finding the right balance between the protection and secure use of data will be key for Europe to remain competitive.

Europe's **dependence on external resources** is another vulnerability as these become increasingly volatile. Consequently, the European industry and, as a major actor, the automotive industry, must increase their resource sovereignty.

Besides shifting to carbon-neutral material sources produced within Europe (e.g., biomass-based), a consistent circular economy across all markets is needed.

To mitigate the negative impact of disruptions, **resilience** is becoming key for systems as vital as the European road transport system to make sure that such systems can continue to provide their functions until they can adapt to sudden, unforeseen changes.

Flexible and dynamic decision-making must enable timely responses to disruptions. This

applies also to decisions on R&I priorities, as technological leadership and the mastery of digital technologies are key to industrial competitiveness and to European sovereignty.

Important decisions may also have to be taken in other areas, knowing that there is no guarantee that other regions of the world will follow similar approaches as the EU.

Still, decisions in the presence of uncertainty should be regarded as possibilities and chances for realising a sustainable Europe ensuring the social and economic well-being of its citizens as well as the mobility of people and goods.

European transport and mobility: EARPA's vision and role

For an efficient future European road mobility system, it will be essential to use a system approach. Using such an approach, considering local and regional peculiarities, allows Europe to connect the UN Sustainable Development Goals with technological, demographic and socio-economic developments and trends.

EARPA's vision for Europe's transport and mobility is based on this need for a system approach, delivering benefits for **society, planet and users**. Building further on these fundamental themes, EARPA's vision of the future mobility system has six central core values:

Accessible

- Our innovations aim to create an impact that ensures mobility is accessible to all road mobility users, wherever and whenever they need it. Mobility offerings should be available and easy to use, for all potential users. The services offered must have good coverage in terms of locations, time and frequency to become accepted. Goods transport must be regarded as an integral part of the overall mobility system, with specific needs and requirements. There is an increasing need for accessibility of sustainable transport services for people and goods, specifically in terms of affordable cost/km for the end user.

Inclusive

- Besides accessible mobility, Europe needs fully inclusive transport and mobility that facilitates access to the job market, education, social meetings and events. An ageing population combined with challenges related to migration, (digital) education and poverty, brings the need to incorporate the social aspect into mobility system developments. This includes both the mobility assets as well as management of the overall mobility system.
- Societal development with an ageing population, increasing poverty and digitally unskilled citizens leads to new groups of socially vulnerable citizens. For several of these users, (social) safety of mobility plays a more and more visible role. The diversity of mobility offerings shows a wide range, especially when comparing different demographic areas, such as urban and rural.

Safe

- Road safety developments are in EARPA's DNA, closely collaborating using a multi-stakeholder approach. EARPA fully supports the EU's goal to move close to zero road fatalities and serious injuries by 2050 (Vision Zero) as well as the premise that no loss of life is acceptable. European, national and local activities have led to many positive developments and effective innovations. Still, road safety requires our action. In recent years, the EU has entered a phase of stagnation in improving road safety. Crash prevention and mitigation of impacts go along with automation and, increasingly, cybersecurity.





Sustainable

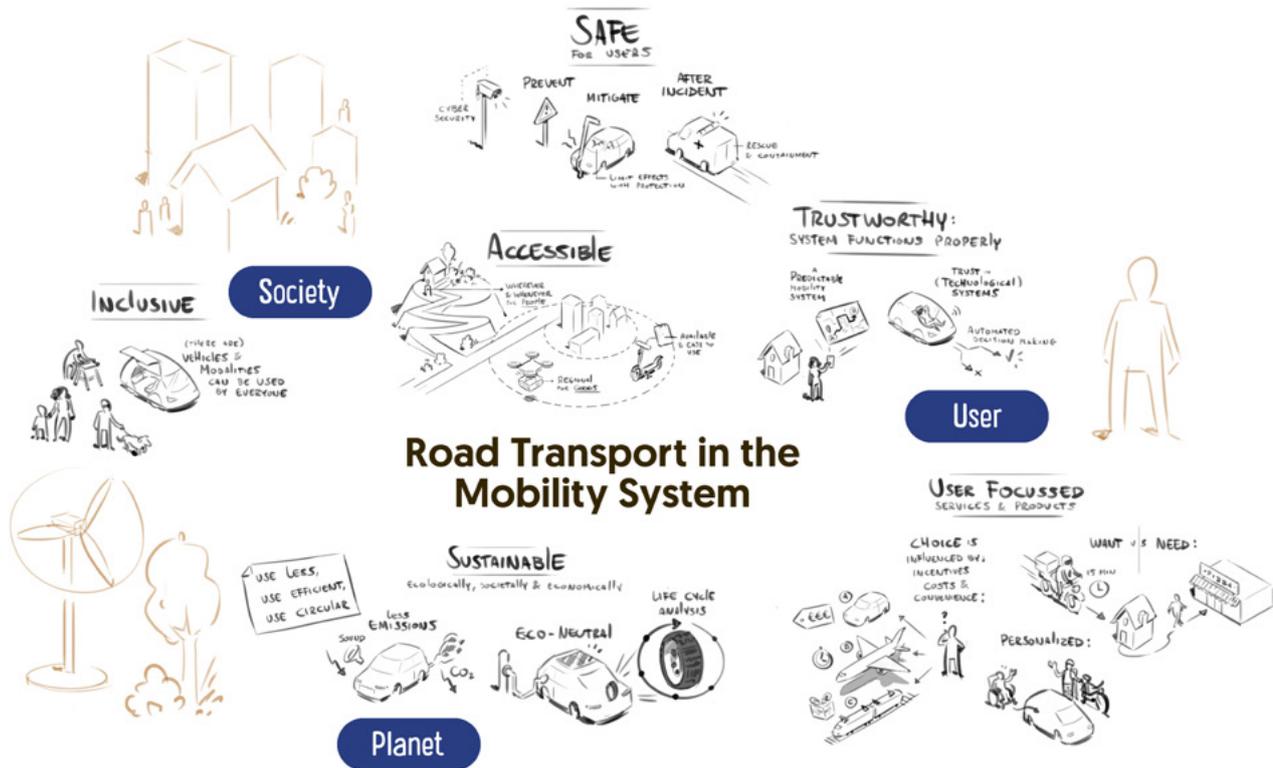
- Clean mobility and lowering emissions have always been core values of EARPA. These will be driven further, yet there is also the need to strive for ecological neutrality. A key component to achieve this is circularity and the life cycle approach, which takes the next step towards closing the circle and counteracting resource scarcity.
- Mobility is increasingly seen as a basic right that can be used at any time, any place and for any need. To preserve a sustainable mobility system in the long term, we need to rethink the need for the transport of both people and goods. The total transport demand and volume should be reduced in an intelligent way, without EU citizens judging this as affecting their personal freedom. The remaining need for transport should be met with reduced use of energy and other resources. It is essential that various technology paths which are CO₂ neutral and sustainable will be further explored.
- To address the economic dimension of sustainability alongside the social and environmental aspects, transport needs to become more efficient. Reducing the demand for energy and material resources without compromising the effectiveness of transport as an important pillar of the economy is an important area of innovation.

Trustworthy

- For users to make sustainable choices to fulfil their mobility needs, a mixture of mobility offerings will be needed. Combinations of shared and individual options, including active modes of transport, need to serve regional needs. The offering must meet the needs of dense urban areas as well as low-density rural areas. In the end, users need a predictable and reliable mobility system.
- The increasing levels of digitalisation in road mobility bring along the need to ensure user acceptance and user understanding. For instance, users must understand, to an extent, automated decision-making in order to accept it, whether this is at a vehicle level for automated driving functions or at a system level. This is an important element to create trust in the technological systems and thus in the mobility offers. This user understanding and consequently user trust, is the key enabler for large-scale uptake of sustainable mobility solutions, equally for goods and passengers.

User-focussed

- The aim of innovations in our sector is to contribute to the well-being of the EU citizens, as well as to support the transition to climate neutrality. Such a development requires a deep understanding of the details of both individual and societal needs and their implications for technical, business-related and societal solutions. However, innovations that benefit the well-being of individuals may at the same time lead to negative impacts for the society as a whole due to unforeseen application of the innovations, because of changing preferences and behaviour of users, or as a result of systemic cross-modal and/or cross-sectoral effects.



The members of EARPA, whose actors complement each other to cover the most of the TRL range, will contribute to establish a new mobility system via research from low to high TRLs, in close collaboration with actors all along the value chain.

European industry, European governments and local and regional governments are key counterparts for innovative collaboration. The needs expressed e.g., by various governmental actors and the scale of actions provided by the mobility industry are to be brought closer together.

EARPA sees a strong role for the association and its members, to build this bridge and to boost innovation for societal impact. Furthermore, many EARPA members play an active role in educating the engineers, economists, researchers and decision-makers of tomorrow, with a strong orientation towards a sustainable future. This is a critical task which needs to be emphasised more, and a joint approach in collaboration with industrial actors is urgently needed.

This long-term collaboration is needed to counteract the growing lack of skilled workforce, which, in combination with global protectionism, leads to Europe losing competitiveness and technological leadership.

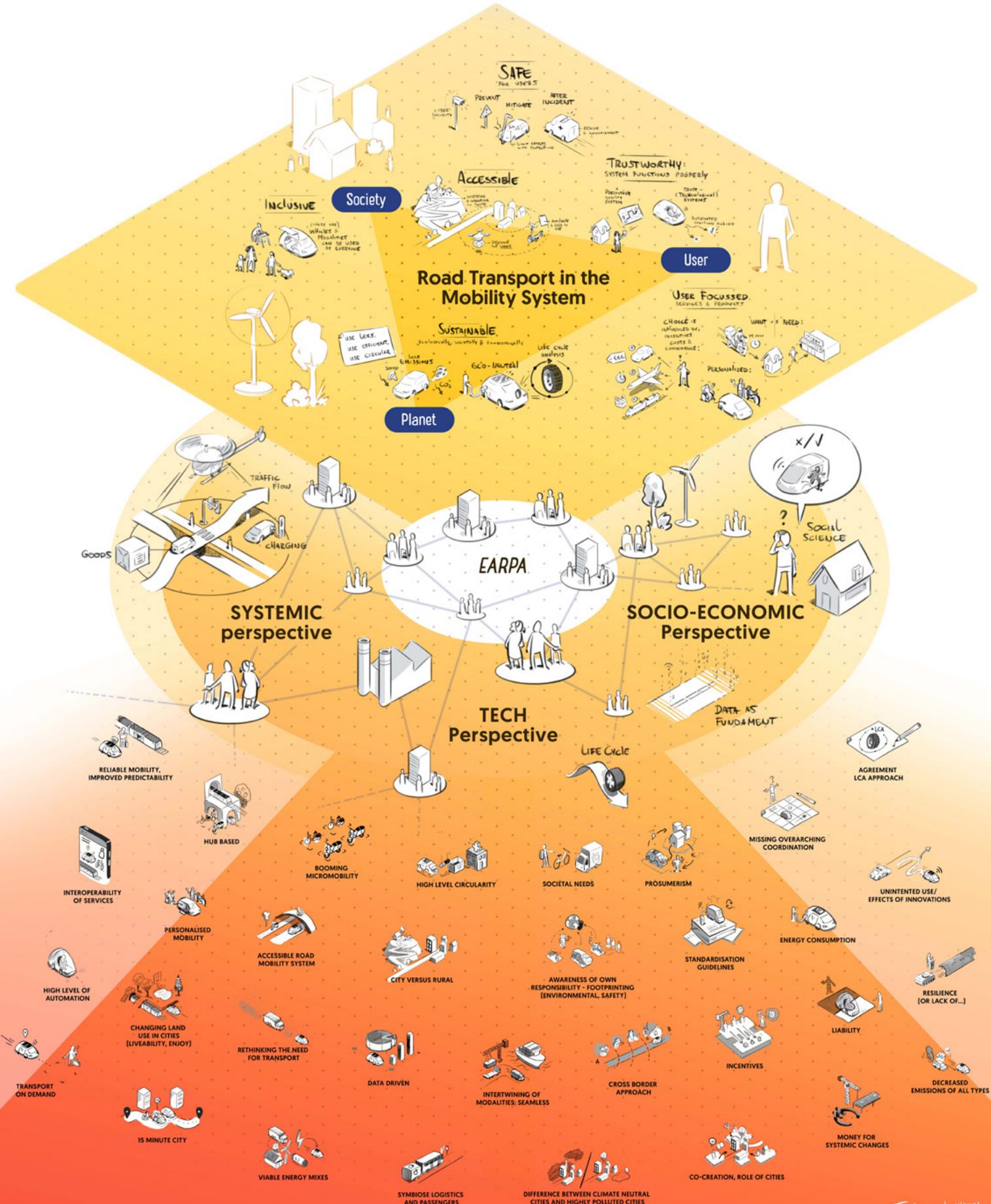
With such stakeholder collaboration in place, the transformation of transport systems will offer the chance for (re-)gaining technological leadership and strengthening the competitiveness of Europe. As Europe is a leading market, it must be at the forefront of the transformation process.

Consequently, suitable regulatory boundary conditions should be set, and agile investments should be made not only in advanced technologies and mobility solutions but also in innovative processes to develop and realise such technologies and mobility solutions.

In this context, the selection and implementation of solutions and technologies based on their environmental and social impact becomes elementary and must become a commonly accepted approach. It is evident that the system approach is the key factor to success.

EARPA sees it as essential to integrate the overall system perspective, the technology perspective and the socio-economic perspective. The aim is to have a valuable rethinking of the need for transport and for the development of a sustainable mobility system for tomorrow connected with energy and other neighbouring sectors.

The future of Road Transport in the Mobility System



EARPA's organisation reflecting its priorities in road mobility R&I

The EARPA Foresight Groups have their specific areas of activity. Within their field, clear research priorities have been set. EARPA recommends the research priorities below for inclusion in e.g., European Partnerships, such as 2Zero and the CCAM Partnerships, in European Technology Platforms, such as ERTRAC and ALICE, and in collaborative research in other parts of Horizon Europe.

In addition, EARPA advocates the launch of a dedicated action/instrument (e.g., a Mission) focussing on “Roads without victims”, going beyond research and driving innovation to finally deliver effective solutions.

Such an action could help to stop the current trend of stagnating fatality and injury figures on European roads and a cumulative total of about 400,000 lives could be saved and ten times as many severe injuries avoided until 2050.

A more elaborated view based on the Foresight Groups can be found in each specific position paper, which can be downloaded from www.earpa.eu. Below, the priorities per Foresight Group are summarised:

Foresight Group Connectivity Automation Safety

- Optimising the contribution of connected and automated passenger and freight transport to the decarbonisation of the transport sector, based on new tools and approaches for design for greening. This approach will include optimised scenarios and enable the development of an environment- and energy-optimised mobility system.
- Methodology to quantify the greening impacts of CCAM, including potential impacts and potential further greening options. The methodology is to enable practical as well as political evidence-based decisions on, e.g., city scale, region scale or beyond.
- New enabling technologies for Connected Cooperative Automated Mobility (CCAM) are crucial, in particular, to extend current electronic horizon standards by closing the gap between data and connectivity. Advanced connectivity-enabled functions could make vehicles and other road users share their intentions in a proactive approach towards road safety. The guaranteed availability, interoperability and trustworthiness of data will be key for massive adoption.
- Tools and methods for testing and validation of CCAM and other road safety measures need to be developed to ensure the trust of citizens in the deployment of new products and mobility services. Tools and methods should be applicable to systems that make use of AI, to Human-Technology Interaction (HTI), and to the validation and assessment of road safety measures complementary to CCAM.
- Crash prevention for bicyclists and users of other micro-mobility devices is needed to ensure the safety of unprotected and partially protected road users. This includes aspects such as innovative vehicle designs, cooperative automatic conflict resolution, FOTs with crash prevention innovations, safety assessment (including behavioural modelling), validation methodologies and type approvals.

- Artificial Intelligence (AI) is becoming an important technology in the development of CCAM systems. The verification of AI modules to comply with safe driving patterns and ethical principles becomes crucial. Therefore, reliable verification methods must be developed and validated. Underlying is the need for advanced approaches and tools for the design, validation and monitoring of AI-enabled, distributed and neuromorphic CCAM architectures and systems, as well as the software-defined vehicle. Furthermore, AI and smart data for the prediction of road crashes are to be advanced.
- Crash safety in future scenarios of road transport will require appropriate crash safety systems for highly and fully automated vehicles, further research on light, affordable and crashworthy vehicle body structures, and virtual human body models with improved bio-fidelity and new biomechanically based injury criteria, including the adaptation of such models to evaluate personal protection devices and forgiving road infrastructure for the riders of two-wheelers.

Foresight Group Powertrains and Energy Systems

- It is of high importance to understand the energy system in Europe in-depth, the possibilities to store temporary renewable excess energy in Europe, but also to import dedicated chemical renewable energy from outside Europe, and understand which mixture of energy carriers in transport makes sense. A holistic and broader understanding of the future energy flows and use scenarios in Europe will be required to support the identification of optimal energy carriers (electricity, H₂, e-fuels etc.) for each unique (region-dependent) road transport mission and to provide a fast track to fossil-free mobility through a better match between renewable energy sources and innovative drivetrain technologies. These considerations need to take the infrastructure and the electricity grid into account, as well.
- Adapted methodologies based on well-to-wheel approaches as well as life cycle analyses are required to assess viable combinations of vehicles equipped with various electrified powertrain types and empowered by a mixture of sustainable and or renewable energy sources. This is essential to effectively speed up transport defossilisation and to identify truly sustainable future mobility solutions.
- Innovative concepts must be developed to make the vehicle fleet cleaner and more efficient, identifying better fuel and engine matches to improve hybrid powertrains with minimized well-to-wheel CO₂ emissions and near zero real driving emissions, and supporting the large-scale deployment of EVs with advanced technologies such as rare-earth-free high-speed electric motors and miniaturized power electronic modules.
- New predictive and real-time control strategies are required at a system level for total and continuous optimization of real driving emissions and/or energy use of future fully connected vehicles.
- It will be crucial to develop advanced renewable energy storage technologies that will adapt to various charging patterns for EVs while offering increased lifetime with reduced costs, and while providing more sustainable opportunities for second life, repair, re-use and recycling based on LCA and circular economy considerations.

Foresight Group Integrated Product and Process Development

- Future mobility concepts face unprecedented multiple targets arising from digitalisation, safety, automation and electrification, and this by employing circular economy (CE) approaches. Cutting-edge solutions based on sustainable materials concepts must be developed enabling CE-compliant, affordable lightweight (multi-)materials and joining solutions while guaranteeing reliability, NVH (Noise, Vibration, Harshness), comfort and crashworthiness.
- New materials for energy conversion and storage are required for the sustainable defossilisation of the automotive sector. Essential key parameters such as safety, costs, energy and power density as well as efficiency and durability have to be optimised and assessed against environmental improvements and availability of critical raw materials.
- Sustainability as a requirement to preserve our ecosystem as well as the increasing importance of demand-driven approaches have become critical issues for the automotive industry. As such environmental-friendly production and End-of-Life processes for circular-economy-based vehicle concepts must be developed enabling production in a robust and agile way.
- To quickly implement new climate-neutral technologies, the automotive industry product development cycles are being shortened. This is stressed further by the need to meet consumer demands and deal with new supply chain demands. Advanced tools and methodologies allowing for multi-scale and multi-domain simulations as well as a front-loading of impact assessments, such as LCA, and enabling the fastest design, testing and flexible production of vehicles are needed.
- Advanced vehicle concepts are needed to meet the demands of a mobility system under transformation. Driven by economic, environmental and societal challenges, innovative designs in future vehicle concepts will have to be established, balancing performance, attractiveness and affordability with sustainability and resource efficiency while taking modularity and scalability into account.

Foresight Group Mobility for People and Goods

- The transition to a more and more digitised transport system requires a deep understanding of the needs and demands of all stakeholders. It implicates everything from the individual citizen, small and large businesses and their business models, to governments and other regulatory authorities, all dependent on interlinked systems. The complexity of the transport system requires a multi-modal integration approach enlarging cooperation between old and new actors, including sharing or pooling solutions for both users and infrastructure.
- Digitalisation and intelligent solutions will be enablers for a user-centred approach of seamless travel experience for people and for goods where urban, rural and interurban mobility is connected, also in relation to e-commerce and an increasing individualisation of loads/parcels.
- Services and solutions must seek for minimised environmental impact. Areas such as Vision Zero on noise emissions, as well as defossilisation, air quality and effective traffic management, are crucial to improve liveability and are a priority by city authorities.

- Methods and tools for integrating charging infrastructure into the energy grid will become a critical area where responsibilities, technologies, ownership, investments, financing service and maintenance need to be addressed. Other considerations regard energy supply and energy availability.

Foresight Group Collaboration and Project Management

- The nature of this group differs from the previous ones, having technology and application domain-agnostic activities. The Foresight Group Collaboration and Project Management (CPM) gathers EARPA experts in EU project management. The FG fosters the collaboration between all EARPA members by equipping them with useful and current knowledge about funding mechanisms and their requirements, project management processes, proposal writing, con-tracts management, project reporting, etc.
- By raising important questions during workshops and giving each other advice on current pro-ject management issues and organisational topics, the FG CPM members enhance their collaboration and stimulate the submission of high-level quality proposals, the execution and conclusion of impact-driven EU-funded mobility projects with strong participation of EARPA members.



Abbreviations

Abbreviation	Meaning
CRG	Collaborative Research Group
CCAM	Connected, Cooperative & Automated Mobility
EC	European Commission
EARPA	European Automotive Research Partners Association
EU	European Union
ETP	European Technology Platform
FG	Foresight Group
GDPR	General Data Protection Regulation
LCA	Life Cycle Analysis
MaaS	Mobility as a Service
MS	Member State (of the EU)
NVH	Noise, Vibration and Harshness
R&I	Research and Innovation
R&D	Research and Development
TRL	Technology Readiness Level
UN	United Nations

EARPA Members





Any questions?

Please contact us or visit our website:

info@earpa.eu | www.earpa.eu
[linkedin.com/company/earpa/](https://www.linkedin.com/company/earpa/)

**EARPA - EUROPEAN AUTOMOTIVE
RESEARCH PARTNER ASSOCIATION**

**Av. Adolphe Lacomblé
1030 Brussels, Belgium
October 2023**