



**EARPA High-level
Position Paper 2020**

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Introduction

The United Nations Sustainable Development Goals¹ show a shared, global responsibility for us all. They are the blueprint to achieve a better and more sustainable future for the population of the world and our planet. Road mobility is an important link to several of these Sustainable Development Goals (SDG), including (9) Industry, Innovation and Infrastructure; (11) Sustainable Cities and Communities; and (13) Climate Action.

The Global Challenges that Europe faces in relation to road transport include energy security - covering the improvement of energy efficiency and the use of new energy sources - as well as climate change and environmental issues. Furthermore, road safety, disruptive events, such as the COVID-19 outbreak, as well as the consideration of the social and demographic change, plus the need for improved European competitiveness, are all challenging our current mobility system in (peri-)urban and rural areas.

The only viable option to deal with these challenges and the SDG's is by working with a systems approach, in which single technologies contribute to the overarching aim; a sustainable future for all.

EARPA members are well positioned in the stakeholder field addressing these challenges. EARPA members are the trusted and independent R&I partners for a wide variety of actors, ranging from SMEs and start-ups, to large international industrial actors as well as Member State governments and local governments. The extent of the EARPA members' competences, with this wide stakeholder engagement, has enabled EARPA to make a valuable contribution to the European Research Area, in terms of research delivery, innovation and strategic vision. Through the activities of EARPA's Foresight Groups, ideas and priorities for research have progressed and are shared with many stakeholders and European Technology Platforms, whereas the EARPA Collaborative Research Groups support the members to successfully participate in European and Member State supported research programmes, contributing to the development of many transport key technologies.

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

EARPA

Bringing together the most prominent independent R&D providers on road mobility throughout Europe, EARPA's mission is to promote awareness and understanding of the specific role and contribution of R&D providers in the automotive sector and reinforce the high tech character of the automotive industry as well as its potential for future innovation and new opportunities.

Foresight Groups and Collaborative Research Groups

The backbone of EARPA are the Foresight Groups and Collaborative Research Groups.

The objective of the Foresight Groups is twofold:

1. Identify and advocate EARPA R&I and technology priorities, for example via joint road-mapping, and by compiling and structuring mid-term and long-term R&I needs and impacts. The results of this can be position papers and collections of inputs towards ETP and EC roadmaps, and are being used in discussions with sectoral stakeholders.
2. Scout future collaboration opportunities for EARPA members, including the sharing of information on ongoing relevant developments, discussions, publications and events. It includes the identification of particular funding programmes on EC level and coordinated Member State level, which serves as input for the Collaborative Research Groups.

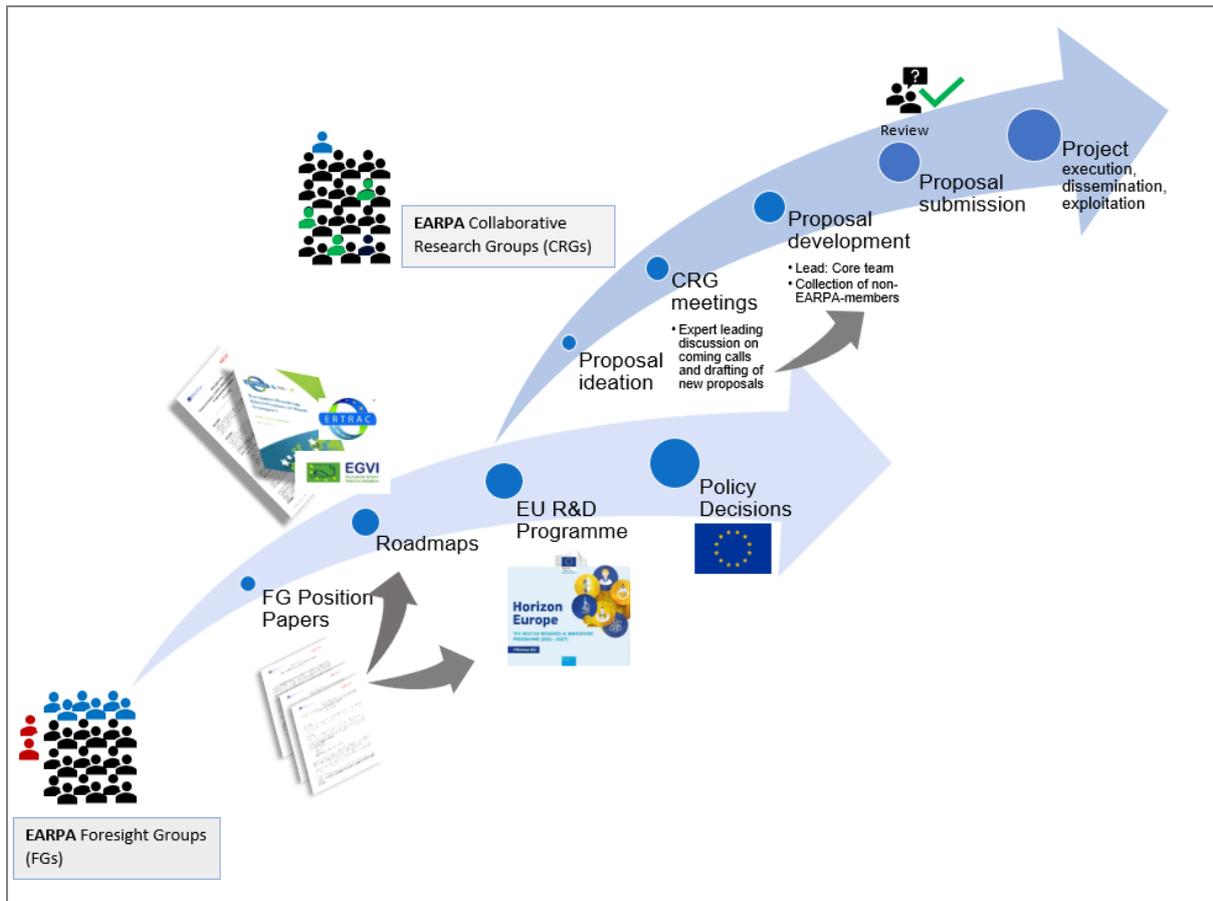
The thematic focus areas of the EARPA Foresight Groups are as follows:

- Connectivity, automation and safety
- Energy, powertrains and electrification
- New materials, production processes, novel vehicle concepts including NVH
- Future mobility of people and goods (MaaS, logistics, smart cities)
- Project management

The Collaborative Research Groups (CRGs) respond to calls for proposals with EARPA Experts facilitating successful R&I proposal developments. The different open calls are discussed within each dedicated CRG. These are therefore EARPA's main instrument to help to initiate European funded projects. The CRGs are flexible in focus, as they are programme and call dependent. Within these groups, EARPA members can promote and sharpen their project idea to find (EARPA) partners to join a proposal.

Main objectives of the Collaborative Research Groups:

- Reflection on submitted proposals – lessons learnt
- Information on on-going proposals
- Discussion on upcoming calls, initiation of new proposals and collecting partners' interests



This figure shows the interaction and connection of the EARPA Foresight Groups (FGs) and the Collaborative Research Groups (CRGs). The FGs provide input to the R&I framework programmes and the CRGs lead the discussions on the project proposals and reflect on submitted proposals.

European mobility landscape

Global trends and challenges

Challenges like global warming, demographic changes or socio-economic converting processes through new technologies, like digitalisation or artificial intelligence, are affecting every aspect of our daily lives. Furthermore, in a globalised world, society has become more sensitive to disruptions like pandemics and other human or nature caused events. In fact, the economic and humanitarian crisis caused by the COVID-19 outbreak, global warming as well as geopolitical tensions are more than ever calling into question a concept of economic prosperity and social stability based on continued material growth, the intensive use of limited natural resources and accompanied by ever increasing mobility of people and goods. However, societies in different regions of the world do respond differently to global challenges and such disruptive events. While fighting hunger, poverty, and precarious economic situations by traditional concepts of economic growth may be given priority over fighting global warming in other parts of the world, Europe has the chance to act differently, and the Green Deal can be seen as an important step in this direction.

Also, with regards to urbanisation, divergent trends may be anticipated in different parts of the world in the coming years. While in Asia or Africa, urbanisation may well be accelerated, in Europe, this trend might be reversed over the next decades. Digitalisation, virtual reality 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, as new ways of medical diagnostics and treatment or logistics and cultural offers become more widely available enabling moving back to rural areas or at least to the urban fringe (peri-urban). The shift from local retail to e-commerce and urban access restrictions may also add to this by increasing the attractiveness of other business locations than city centres.

At the same time, globalisation has also been driving regionalisation on different levels, within the EU as well as within Member States. With regard to mobility, this may facilitate solutions to be tailored to regional and behavioural particularities, but it can also mean a challenge to seamless mobility. The de facto introduction of new regional borders to the mobility of people and goods by regional actors taking divergent approaches to solve local challenges definitively needs to be avoided.

The handling of data is another important area in which different parts of the world follow different concepts. While society in Europe shows high appreciation for data protection and the EU has put in force a comprehensive 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, and the ability to exploit them will become an even more important competitive advantage in the future.

While these 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. Therefore, in presence of uncertainty, 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. Moreover, decision making needs to be flexible and dynamic to be able to react timely to disruptions. This applies also to decisions on R&I priorities. The importance of technological R&I should not be underestimated in this context, as technological leadership and the mastery of digital technologies in particular is key to industrial competitiveness and likely to become key to European sovereignty, as well.

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 understood as chances – chances for realising a sustainable Europe ensuring the social and economic well-being of its citizens as well as free movement of people and goods.

European mobility: EARPA's vision and role

A systems approach for the future European road mobility system will be key in connecting the UN Sustainable Development Goals and the Global Challenges used by the European Commission with the technological, demographic and socio-economic developments and trends outlined above.

Multiple drivers are currently reshaping the mobility landscape:

- **Social drivers** including demographic and behavioural changes, such as migration between rural and urban areas, aging of population and shifting user preferences. This also includes a more conscious decision making on the actual need for mobility (including pandemic issues or new work concepts), for example combining trips, minimising the number of trips, as well as a modal shift amongst others towards active modes of transport.
- **Market drivers** including the rise of circular economy, sharing economy, data economy and the demand for tailored mobility solutions (including MaaS), e-commerce, *prosumerism* (phenomenon that someone acts as producer and as consumer) and green consumerism adding new roles in the service chain. At the same time, *glocalisation* (globalisation going hand in hand with strong tendencies towards localisation) has an important influence on worldwide markets for mobility solutions.
- **Regulatory drivers** including environmental and health targets and policies, a wide variety of urban access restrictions, more stringent global standardisation, as well as the drive towards zero fatalities and severe injuries from transport accidents (Vision Zero).
- **Technology drivers** including electrification, digitalization, connectivity, artificial intelligence and automation.
- **Major disruptive events** or incidents that are difficult or impossible to predict, but which will require rapid interventions, technical and social adaptations or novel solutions (for instance the COVID-19 outbreak).

These drivers combined can lead to major structural transformations of our transport systems for both people and goods towards climate-neutral and near zero emission. Resilient, safe, affordable and inclusive mobility for all, giving citizens the freedom to travel whenever and wherever they wish while removing the need for trips which do not add to their quality of life. In order to cope with disruptions, solutions must also be inherently dynamic and flexible. Such a transformation is only feasible on a system level involving all stakeholders like end-users, industry, operators, researchers, cities and politicians. This is strengthened further by the growing demand for user-driven solutions, and for user-centric solutions. Contributions to this transformation will partly come from new actors and surely from solutions integrating all suitable transport modes without predefining any technological approach.

The EARPA member network contributes to establishing a new mobility system by research from low to high TRL's, in close collaboration with actors from along the full value chain. 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.

With such stakeholder collaboration in place, the transformation of transport systems will be a chance for (re-)gaining technological leadership and an element to strengthen the competitiveness of Europe. Europe, as leading market and technology provider for transport solutions, will have to be at the forefront of the transformation process. Consequently, suitable regulatory boundary conditions should be set, and agile investments be made not only in advanced technologies and mobility solutions but also in innovative processes regarding the development and realisation of such technologies and mobility solutions. Within this context, especially the selection and implementation of solutions and technologies based on their environmental and social impact becomes elementary and must become a commonly accepted approach.

EARPA's top 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.

Foresight Group Connectivity Automation Safety

- *New enabling technologies for Connected Cooperative Automated Mobility (CCAM)* are crucial, in particular to extend current electronic horizon standards by closing the gap of data and connectivity. Advanced connectivity enabled functions could make vehicles and other road users share their intentions in a proactive approach towards road safety and potential greening of transport. Guaranteed availability, interoperability and trustworthiness of data will be key for massive adoption.
- *Tools and methods for testing, validation and (self-)assessment of the security of connected objects and the upcoming generation of electronics* in the road transport industry need to be developed to ensure the trust of citizens in the deployment of new products and mobility services. Tools need to be user-friendly and easy to integrate in existing tool chains for security level assessments.
- Artificial Intelligence (AI) is becoming an important element 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. This implies amongst others the challenge to make desired ethical behaviour explicit.
- With an increased speed of technological development, but relatively slow penetration rates, safety analysis methods need to be extended to the *predictive assessment of safety risks and system effectiveness* in future scenarios. Scenarios have to be provided which cover more complex transport system levels where safety can be described in terms of risk and probability due to multiple driving forces. This requires amongst others appropriate virtual simulation environments and realistic models of all elements of the road transport system.
- *Smooth interaction between all road users, their vehicles and infrastructure in a safe system approach* requires vehicle-internal and -external human-technology interfaces becoming highly intuitive and adaptive to user needs, considering both safety and acceptance criteria. It also calls for the smooth inclusion of new means of transport into the road transport system based on a comprehensive analysis of how the transport system will change with increased automation and how this will affect scenarios related to safety.
- *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 biofidelity 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 Energy, Powertrains, and Electrification

- It is of very high importance to understand in depth the energy system in Europe, the possibilities to store temporary renewable excess energy in Europe, but also to import dedicated chemical renewable energy from outside Europe. Furthermore, it is important to understand which share of energy carriers in transport is best. A holistic and a 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.
- Adapted methodologies based on well-to-wheel emissions and life cycle analyses are required in order to assess all the possible combinations of electrified powertrains types and of renewable gaseous and liquid fuels so as to speed up transport defossilisation and to identify truly sustainable future mobility solutions.
- Innovative concepts are required to be developed to make the vehicle fleet cleaner and more efficient, identifying better fuel and engine match to improve hybrid powertrains with minimized well-to-wheel CO₂ emissions and near zero real driving emissions, and supporting the large-scale deployment of EV 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 a 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 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 and Connected Product Development

- Future mobility concepts face the unprecedented multiple-targets challenge of digitalisation, safety, automation, electrification by employing circular economy system. To address these, cutting-edge solutions based on advanced materials concepts must be developed enabling advanced lightweight multi-materials and joining solutions while guaranteeing durability, comfort and crashworthiness by means of reliable, feasible and affordable solutions.
- New materials for energy conversion and storage are required for the sustainable defossilisation of the automotive sector. Essential key parameters of energy storage and conversion such as safety, costs, energy and power density as well as efficiency and durability have to be further optimised and assessed against environmental improvements and availability of critical raw materials.
- Sustainability as required to preserve our ecosystem as well as increasing importance of demand-driven (e.g. digitalization of the mobility, customisation) has become a critical issue for the automotive industry. As such environmental-friendly production and End-of-Life processes for circular-economy-based vehicle concepts must be developed enabling to produce in a robust and agile way.
- In order to stay competitive and to implement climate-neutral technologies, the automotive industry product development cycles have to be shortened significantly. Furthermore, needs to meet consumer demands and to deal with new supply chains demand for shorter go-to-market timelines. Therefore, 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 fastest design, testing and flexible production of vehicles are needed.

- Advanced vehicle concepts are needed meeting 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 a design balancing performance, attractiveness and affordability with sustainability and resource efficiency while taking into account modularity and scalability.

Foresight Group Future 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, 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 solutions for both users and infrastructure.
- Digitalisation including open platform approaches and intelligent solutions will be enablers for a user-centred approach of seamless travel experience (MaaS) for people and for goods where urban, rural and interurban mobility is connected, also in relation to e-commerce and an increasing individualization of loads / parcels.
- Services and solutions with near zero real driving emissions propulsion systems and electrification. Areas like Zero-vision on noise emissions as well as defossilisation, air quality and effective traffic management are crucial to improve liveability and a priority by city authorities.
- Methods and tools for integrating charging infrastructure will become a critical area where responsibilities, technologies, ownership, investments, financing service and maintenance needs to be addressed. Other considerations regard energy supply and energy availability.

EARPA recommends the research priorities above for inclusion either in European Partnerships, such as 2Zero and the CCAM Partnership, or 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.

Besides the contributions to the technological developments and R&I activities, EARPA and its members have a joint interest, which supports and is supported by the ***‘Implementation Strategy for Horizon Europe’***:

- Having the impact of a coherent portfolio of R&I projects as a selection criterion in addition to the intrinsic quality of the individual proposals.
- Creating a European R&I Data Hub.
- Incentivising project partners to continue the reporting beyond the life of the project, taking lessons learned to the longer term as well.
- Using more simplified forms of cost removing the need for financial audits and for having time sheets, moving from time-based to performance-based funding.
- Introducing System and Process Audits leading to fewer Certificates of Financial Statements and less intense futures audits.
- Easing access to alternative funding (by national or regional bodies) when Horizon Europe budget cannot cover all high-quality proposals.

In addition, EARPA encourages flexible and dynamic decision making on R&I priorities. In the presence of uncertainty and the possible occurrence of disruptive events, some future R&I needs may not be fully conceivable at the beginning of a 7-years R&I framework programme. Reserving budget for fast interventions may be a solution to facilitate timely reactions.

Conclusion

A European Research Area for Road Transport

The Horizon Europe Framework Programme, like its predecessor Horizon 2020, will offer 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 membership of EARPA has identified the key research themes, in relation to the main challenges and drivers for the road transport arena. In addition, broader issues related to research and innovation in Europe in general have been raised. 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. EARPA and its membership look forward to a continued, successful, European wide collaboration in the research area of road transport to help establish a systems approach, and a systemic, sustainable transformation of the European road mobility arena.

Abbreviations

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