

# **ERTRAC STRATEGIC RESEARCH AGENDA INPUT TO THE 9<sup>TH</sup> EU FRAMEWORK PROGRAMME**

## **LUXINNOVATION EXECUTIVE SUMMARY**

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# ERTRAC STRATEGIC RESEARCH AGENDA INPUT TO THE 9<sup>TH</sup> EU FRAMEWORK PROGRAMME

## FOREWORD

This document aims to provide the transport research and innovation stakeholders in Luxembourg with the main content and information elaborated in the ERTRAC Strategic Research Agenda, which was published on 23 March 2018 and launched at the Transport Research Arena 2018 Conference in Vienna on 16-19 April 2018.

ERTRAC ([www.ertrac.org](http://www.ertrac.org)) is the European Technology Platform gathering all research players in the field of road transport. Its uniqueness lies in its public-private multi-stakeholder nature: it involves industry, academia and research providers as well as public authorities on the national and local levels. ERTRAC works in close cooperation with the European associations that represent the different aspects of road transport, and has also developed collaboration with other European Technology Platforms. The work of ERTRAC is aligned with the needs and recommendations of the European Commission. The full text of the Strategic Research Agenda is available on the [ERTRAC Website](http://www.ertrac.org).

This document has been prepared by the European Funding Team of Luxinnovation. Its aim is to provide the Luxembourg transport research and innovation stakeholders with a summary of the full Strategic Research Agenda in order to increase their knowledge of the evolution of transport research in Europe. The ultimate goal is to help them align their activities with the next Horizon 2020 calls as well as, with the future multiannual 9th Framework Programme (FP9) and facilitate their discussions with strategic partners.

# INTRODUCTION

The **Strategic Research Agenda** (SRA) is a key document of ERTRAC elaborated to prepare the next European Research Framework Programme. This new version is meant to **support the development of FP9**. Therefore, it provides an overview of innovation challenges and suggests research and development topics for the period 2020-2030.

The document is structured in six chapters based on the new vision of ERTRAC, which provides long-term objectives for the improvement of road transport by 2050 to **connect research with societal needs**. In preparation of FP9, ERTRAC highlights major opportunities that will arise due to forthcoming innovations in road transport. Major transformations of the European mobility system, will take place due to the development of alternative energies, electrification, automation, digitalisation and the sharing economy. The European Member States must act together in order to exploit the potential of these innovations fully and to **develop Europe-wide solutions, achieve technology leadership and maintain research excellence, production and jobs in the European Union**. All these research efforts are recommended for the short and medium term timeframe, in order to introduce new innovations on the market from 2030 onwards and progressively deploy them on a mass-market scale towards 2050.

ERTRAC also calls for a well-balanced funding programme addressing the full cycle spanning from fundamental and long-term research to applied research and deployment. European pre-competitive collaborative research has very high added value because it brings together the many private and public stakeholders who are involved in transport. Their partnerships and cross-sectoral collaboration are important assets to speed up the innovation process in Europe.



Source: ERTRAC

The research topics proposed in this document have been prepared by experts from the ERTRAC member organisations gathered within the six ERTRAC Working Groups:

- **Urban Mobility**, led by Karen Vancluysen, Polis / Andres Monzon, Transyt, UPM;
- **Energy & Environment**, led by Heather Hamje, CONCAWE / André Jarasse, Renault;
- **Long Distance Freight Transport**, led by Bernard Jacob, IFSTTAR / Isabelle Schnell, Volvo Group;
- **Connectivity and Automated Driving**, led by Mats Rosenquist, Volvo Group / Armin Graeter, BMW / Eckard Steiger, Bosch / Manfred Harrer, ASFINAG;
- **Road Transport Safety & Security**, led by Peter Urban, IKA, RWTH / Maurizio Miglietta, FCA CRF;
- **Global Competitiveness**, led by David Storer, FCA CRF / Thilo Bein, Fraunhofer LBF.

## ENSURE MOBILITY IN URBAN AREAS

VISION 2050: “PEOPLE AND GOODS CAN REACH THEIR DESTINATIONS IN CITIES IN A WAY THAT IS HEALTHY, SAFE, AFFORDABLE, RELIABLE AND COMFORTABLE”

- **Walking and cycling together with collective and shared mobility services** form the backbone of urban mobility, complemented by private vehicles.
- **Mobility is higher but fluent**, inclusive and sustainable.
- **A sustainable and healthy mobility behaviour is encouraged** thanks to informed choices.
- **Mobility on demand** including carsharing and ridesharing is available.
- **The improved utilisation of shared vehicles and new technologies** have released former parking areas and other infrastructures for new use.
- **An intelligent and dynamic access regulation** has been put in place.
- **Smart, automated and dynamic parking management** is available and includes smart charging.
- **Pro-active traffic and incidents management** is available.
- **Tranports are emission free** in urban areas.
- **Smart city logistics** builds a link with passenger transport and long-distance freight transport.

## RESEARCH TOPICS 2020-2030

### 1. Understanding the changes in cities: interactions between land use, transport, technologies and users

This topic addresses land use, user acceptance/uptake/adoption, the potential of ITS, Big Data and IoT, different rates of roll-out, with the main expected impact of improved quality of urban spaces.

### 2. Simulation, planning tools and assessment methods to support evidence-based decision-making

This topic deals with quantitative analysis of innovative solutions related to the most relevant transport KPIs (decarbonisation, congestion, noise, modal shift, etc.), as well as with the secure collection, storage, and use of data. The main expected impact is to reduce risks in the adoption of new technologies and support new business models and mobility services.

### 3. Tools and roll-out of integrated pro-active demand-responsive road transport network management

The aim of this topic is to have digitally enabled dynamic network management tools in order to achieve an effective coordination of players, networks and modes, resulting in more inclusive, comfortable, accessible, flexible infrastructure and multimodal user and citizen centric services.

### 4. Interchange infrastructures and services for smart and seamless intermodality

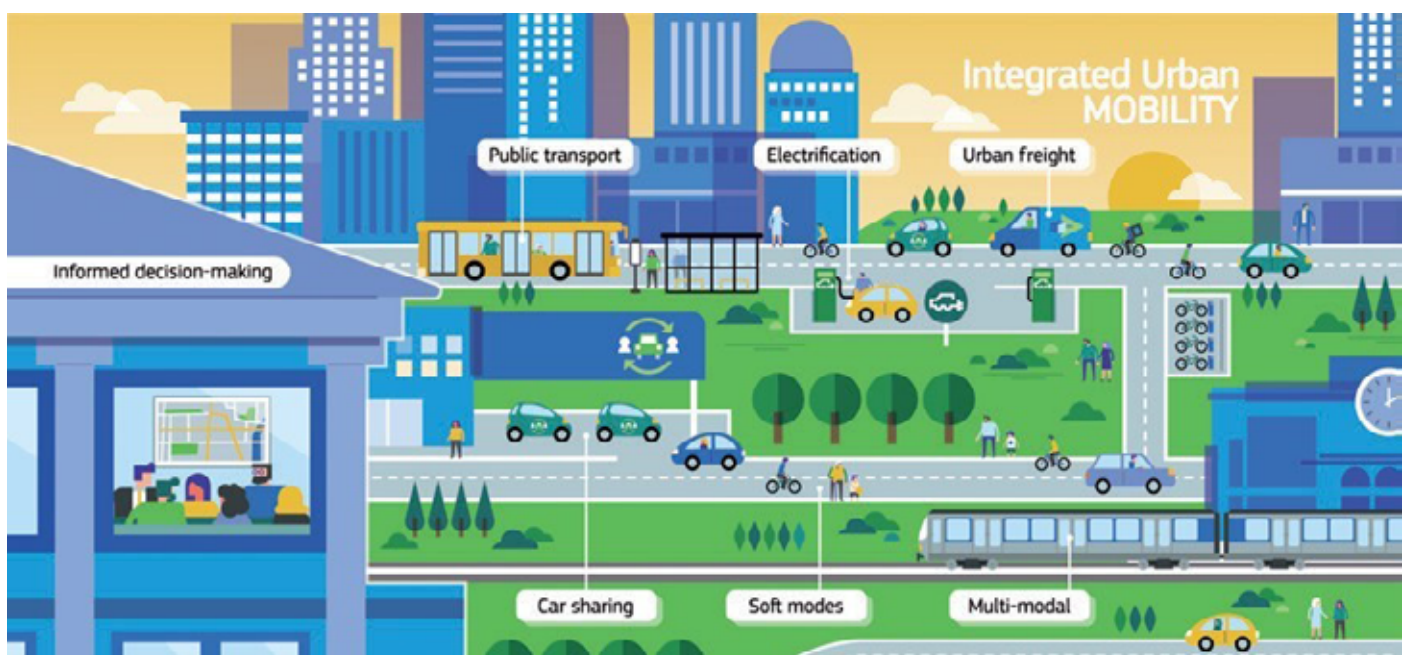
This topic deals with planning approaches and business models for smart hubs enabling seamless multi-modality and the urban transport energy shift, designed with regard to legacy systems.

### 5. New sustainable and smart ways of delivering goods to make better use of urban space

The aim of this topic is to challenge adverse impacts of increased freight and waste transport as a result of a growing urban population, an increasing population density and new buying patterns, for instance due to e-commerce.

### 6. Requirements and concepts for new vehicles for urban use

This topic aims at developing the next generation of vehicles (all sizes from bicycles to buses) specifically designed and optimised for urban operation in terms of range, platoon capability, full connectivity and smart HMI based on configurable modular architectures and fully inclusive towards specific user demands.



Source: ERTRAC

# ENVIRONMENTAL SUSTAINABILITY: ENERGY AND RESOURCE EFFICIENCY, DECARBONISATION AND AIR QUALITY

VISION 2050: “CO<sub>2</sub>-NEUTRAL ROAD TRANSPORT WITH MINIMAL ENVIRONMENTAL IMPACT INCLUDING CIRCULAR ECONOMY FOR VEHICLES AND INFRASTRUCTURE”

- **100% renewable energy** for transport (electricity, alternative fuels);
- **Emissions free urban areas;**
- Negligible or **near zero emission** in rural areas;
- **Energy efficient road vehicles** in real world conditions;
- **Gapless energy supply** – charging infrastructure and alternative fuels everywhere needed;
- **Circular economy** for vehicles and infrastructure;
- **Affordable and energy efficient vehicle production** and maintenance.

## RESEARCH TOPICS 2020-2030

### 1. Renewable, low-carbon advanced fuels: low cost sustainable production, storage and distribution

This topic focuses on R&D challenges related to more energy and CO<sub>2</sub> efficient production methods for traditional and new fuels. Novel ways of storing and distributing these fuels may be desirable as well as the infrastructure that will make them freely available wherever needed whilst minimizing further emissions.

### 2. Highly efficient, fully electric battery powertrains and vehicles long-range electric passenger cars

The aim is to develop electric vehicles with longer ranges as well as connected and automated vehicles to take advantage of efficiency gains obtained from these modes of driving. R&D needs include energy efficiency gains by light weight construction in combination with active safety systems. Research into tyre and brake materials could contribute to reduce residual particulate emissions.

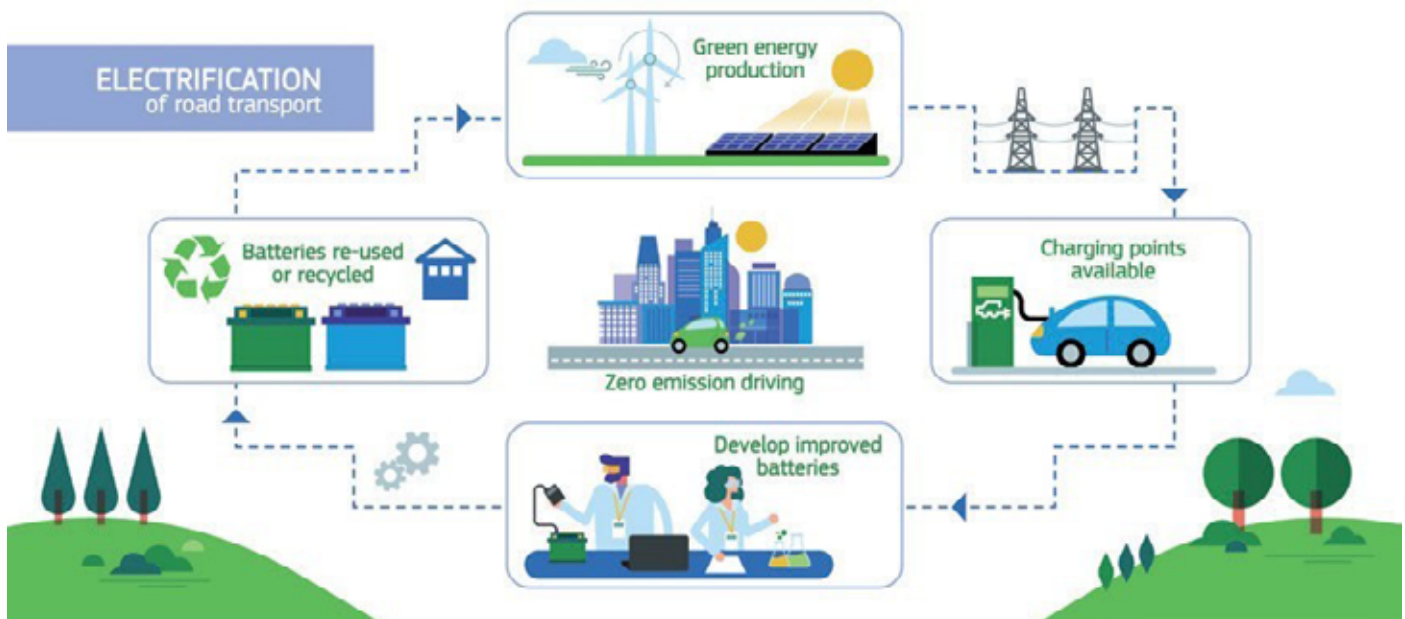
### 3. Highly efficient, fully electrified bus system (urban, suburban and inter-urban)

Shared and public transportation will play an important part in the decarbonisation of transportation and will include a fully electrified urban bus fleet that successively is extended to electrified rural buses and integrated with other “last mile” solutions. Research should focus on propulsion and charging systems, to achieve a seamless integration of transport modes within urban logistics

### 4. Highly efficient electrified long distance trucks and coaches (and roads)

The topic covers the development of hybrid powertrains and architectures as well as solutions relying on integration with the road infrastructure. Energy efficiency of electric batteries for trucks and coaches will be important and should include on-route charging in combination with efficient operation, improved energy recovery and logistics for longer range trucks and coaches.





Source: ERTRAC

#### 5. Highly efficient, (plug-in) hybrid powertrains and vehicles for passenger cars and delivery vans

Particular efforts are required to develop new dedicated hybrid powertrains with the best combination of advanced ICE, electric propulsion and transmission technologies to give the best product attributes including energy efficiency and cost. This topic also includes the possibility of taking advantage of V2X connectivity for energy management.

#### 6. Disruptive ultra-low emission concepts for near-zero emissions

The objective of this topic is to realise affordable hybrid powertrains contributing to near-zero emissions for passenger cars and delivery vans. This includes the balance between operation in full electric mode in urban areas and a combination of thermal and electric propulsion for inter-urban journeys.

#### 7. Highly efficient ultra-low emission ICE and other powertrains for long-distances

This topic covers the development of new advanced fuels for propulsion systems involving or not combustion (e.g. fuel cells). Research needs will include powertrain control management system which will be crucial, have the flexibility to handle different fuels and be optimised for these fuels. They might also include fuel quality sensing capability.

#### 8. New battery and convenient charging opportunities for different use cases: urban charging, high power charging, power transfer technologies

Compact, light and affordable batteries with better tolerance to extreme temperatures will be needed for attractive and energy-efficient cars. The topic addresses the research to define the chemistry and to develop solutions aimed at performance beyond current Li-ion capabilities. In parallel to battery improvement, the infrastructure evolution needs easily deployable, cost-effective and interoperable charging stations as well as ultra-high-speed charging stations.

#### 9. Second life / recycling and recuperation of materials including energy balance

This topic focuses on research into sustainable production and the development of cost-effective processes to produce energy supply units based on reused automotive batteries including standards and advanced cost and energy efficient processes to extract rare materials for reuse (aluminium, copper, nickel, cobalt, etc.).



# ENSURE AN EFFICIENT AND RESILIENT ROAD TRANSPORT SYSTEM

VISION 2050: “INFRASTRUCTURE AND TRAFFIC MANAGEMENT PROVIDE HIGH EFFICIENCY ROAD NETWORK SERVICES AT A COMPETITIVE COST LEVEL WITH MINIMIZED CONGESTION, REGARDLESS OF CURRENT CONDITIONS AND DISTURBANCES”

- Trans - European mobility control **supports the pro-active, user-centric and integrated door-to-door mobility** of people and goods.
- **Adaptive and flexible traffic and transport management systems** are available across all transport modes.
- **Performance-based standards** determine the access of freight vehicles to the road network.
- **Physical and digital infrastructure services** across Europe are **appropriately equipped** for automated vehicles and linked to international standards.
- Infrastructure services across Europe are available on “**pay-as-you-use**” basis;
- Construction and maintenance practices are automated, leading to **high cost-efficiency and minimal work-related safety risks and congestion**;

## RESEARCH TOPICS 2020-2030 (LIMITED TO LONG DISTANCE FREIGHT TRANSPORT)

### 1. Pushing boundaries for higher vehicle capacity and efficiency with enhanced compliance

The topic covers innovation aimed at facilitating vehicle efficiency, with an additional focus on the compliance with weight and dimension regulations, in particular with automated means, to optimise traffic and minimise costs (including in cross-border settings).

### 2. Adaptation of road infrastructure for future vehicles and operations

This topic addresses infrastructure improvements necessary for charging and fuelling the next generation of vehicles as well as the development of monitoring, diagnosis and maintenance tools.

### 3. Evolution of logistics hubs, parking lots and networks for future freight operations

This topic aims at fostering the design of multi-modal logistic centres and hubs to achieve an optimal use of each mode within harmonised European networks

# CONNECTIVITY AND AUTOMATION –AN ENABLER FOR IMPROVED MOBILITY

VISION 2050: “DIGITALISATION ENABLES PEOPLE TO GET THE BEST SERVICE AT HIGHEST LEVEL OF COMFORT AND SAFETY”

- **Fully multimodal mobility** offerings including trip planning, pricing and payment;
- **Connectivity everywhere** and at any time with stable connection and data rates;
- **Communication between vehicles and infrastructure** to optimise traffic flows, traffic management and safety;
- **Mobility as a service** regardless of ownership;
- **Predicted demand based on individual behaviour**, enabling an appropriate modal capacity and demand management;
- **Digital technology** for vehicle access regulation, fee payments and prioritisation;
- **Data privacy and international standards** for data exchange and connectivity;
- **Highly automated vehicles** for the inclusion of vulnerable users and people with reduced mobility (PRM);
- Accidents and delays are extremely rare and delays are automatically resolved;
- **Harmonized legal frameworks** for automated vehicles.

## RESEARCH TOPICS 2020-2030

### 1. Deployment of automated passenger vehicles in mixed traffic for improved safety and efficient road transport

This topic covers the need to continue H2020 effort in supporting the deployment of pilot tests with increasing levels of automation (in the short term at level 3, in the medium term at level 4), to understand the impact on users, traffic, and society, with a long term perspective on understanding how integration and connectivity can support automated traffic management.

### 2. Deployment of automated heavy commercial vehicles in mixed traffic for improved safety and efficient road transport

To achieve improved freight mobility and safer and efficient vehicles, this topic calls for research in short distance platooning, multi-brand truck platooning on open roads and, in the long term, transport automation up to level 5 including loading, handling and safe manoeuvring. This topic also includes the necessity to foster research on V2X and V2I for security, access regulation, pricing and payment, and optimal routing, as well as driver acceptance of job changes.

### 3. Fully automated vehicles for urban use

This topic addresses the development and demonstration of concepts for fully automated un-manned vehicles for specific applications for enhanced mobility of people and goods such as robotaxis, bus-trains, innovative freight logistics, hub-to-hub automation, automated modal interchange mobility hubs. These should be developed in parallel with innovation in mobility services and businesses.

### 4. Societal benefits and user acceptance

This topic recalls the need to increase user awareness, acceptance and trust for CAD understand the user behaviour and demonstrate user value in different user groups. This also includes the role of local authorities to maximise the user and society desire for CAD.

### 5. Fleet and traffic management of highly and fully automated vehicles under mixed traffic conditions

Managing fleets of thousands vehicles or more is a challenge requiring novel computational and AI solutions as well as the development of the physical and, in particular, digital infrastructure needed to be able to cope with the real-time management of massive fleets.

### 6. Ensuring safe, secure and resilient CAD

This topic addresses several points, ranging from ensuring functional safety and cyber-security requirements and cases to the specific safety issues related to the sharing of automated and humanly controlled operations and the development of European harmonised methodologies for verification and validations. The aim is to have CAD—vehicles and a digital infrastructure that is resilient to both technical faults and external threats such as cyber-attacks. Data security within the complete system is especially important.

### 7. Policies and regulation support

To enable the quick introduction of CAD products and services on European roads and avoid delays compared to competing regions, this topic aims at ensuring that research and development on testing is linked to future harmonised regulations for vehicle certification, infrastructure requirements and traffic rules.



Source: ERTRAC

#### 8. Connectivity and automation technologies for vehicles and infrastructure: sensors, software, systems-of-systems, high performance computing and artificial intelligence











This topic aims at promoting EU technological leadership, with a range of priorities which, in the short term, are focused on providing robust, complementary and highly reliable sensors. In the medium term, the aim is to develop high computation, networked, on-board artificial intelligence and machine learning for vehicles and infrastructures. The long-term objective is to integrate new physics for sensors and perception analyses, as well as new concepts of artificial intelligence based on neuronal computers.

#### 9. New services for people and goods enabled by connectivity and automation

This topic aims at building new and enhancing existent businesses by developing innovative, reliable, fair and ubiquitous mobility and transport services for private users and logistics operators that are based on global standards and systems. It also aims to promote new models for the sharing of transport assets. It therefore includes data management, privacy and security, and transparency.

## PROVIDE PERFECT PROTECTION: SAFETY AND SECURITY

VISION 2050: "SAFE AND SECURE AT ANY TIME"

-  **Nearly zero accidents and injuries** due to safety functions and automated driving functions in fully connected vehicles, road users and infrastructure;
-  **Optimised and intuitive Human-Machine Interfaces (HMI) according to the idea of cognitive safety;**
-  **Safe and well maintained physical and digital infrastructures;**
-  **Dedicated traffic spaces** for different road users where sensible;
-  **Improved levels of in- and post-crash safety in the remaining collisions;**
-  **Secured privacy;**
-  **Safety and security features** impossible to attack and misuse;
-  **Continuous maintenance of software and system updates constantly improving their performance;**
-  **Systematic verification and validation of cyber-physical systems;**
-  **Resilience:** highly automated management systems to minimise the impact of incidents and accelerate recovery.

### RESEARCH TOPICS 2020-2030

#### 1. Understanding and predictive assessment of safety risks and system effectiveness

The problem of accidents which still occur, even after the implementation of new technologies, needs to be better understood. With growing computer power, safety assessment methods should be extended to the transport system level, to future scenarios and to self-learning systems. It also calls for current data from naturalistic driving studies and accident analyses as input for realistic modelling. This with the aim of enabling anticipated transport governance and well-founded prioritisation of road safety measures.

## **2. Smooth interaction between all road users, their vehicles and infrastructure in a safe systems approach**

This topic has a double layer: firstly the interaction between automated vehicles and other automated and non-automated road users with the aim to achieve the safe inclusion of new means of transport into the traffic system, and secondly, the safe interaction between users with vehicles and infrastructure in the digital traffic system. For the first point, the topic calls for a comprehensive analysis of how the road transport system will change with increased automation. The second part focuses on the human-technology interface, which has to become increasingly intuitive and adaptive to different user conditions related to well-being, behaviour, distraction and fatigue. It also addresses the need for evolving driving skills. For driverless vehicles, it points out the importance of developing an acceptable code of behaviour.

## **3. In-crash and post-crash safety in future scenarios of road transport**








Non-fatal injuries have not experienced the same positive trend as road fatalities over the years. Moreover, existing safety systems do not yet offer the same level of protection to all users. This topic calls for the development of virtual human body models with improved biofidelity, and new biomechanically based injury criteria in order to evaluate personal protection devices and a road infrastructure which is safe also for vulnerable road users. In parallel, for fully automated vehicles, the testing should also focus on the possibility to achieve travelling safely in new seating positions or with increased freedom of movements inside the vehicles.

## **4. Radical improvement of road safety outside Europe and the OECD countries**

Many low- and middle-income countries do not follow the fast technological development in Europe and other OECD countries, in particular with regard to road automation. However, when the technology will arrive, there will be a crucial need to understand what this will mean for the transport system in these countries, especially in terms of road safety.

# EUROPE AS WORLD LEADER IN INNOVATION, PRODUCTION AND SERVICES

## VISION 2050: EUROPE AS WORLD LEADER IN INNOVATION, PRODUCTION AND SERVICES

-  **Excellence** in education, research, and training;
-  **Europe is the first choice for entrepreneurs, world-leading experts and highly skilled workers (Attract and retain the necessary research workforce);**
-  **Cross-sectoral collaboration is fully established;**
-  **Energy efficient and sustainable production in Europe;**
-  **European network for customer oriented services;**
-  **Methods and processes** to accelerate the innovation process;
-  **Develop the new skills and competences needed for the future.**

## RESEARCH TOPICS 2020-2030

### **1. Improved vehicle efficiency through optimised design and weight reduction consistent with the circular economy**

This topic aims at developing and deploying advanced, smart lightweight materials and concepts which are economically viable for automotive applications, as well as multi-material approaches that allow cost-effective material separation, recycling and recovery, taking into account environmental impact through life cycle assessment.

### **2. Development of advanced digital tools exploiting the ‘digital-twin’ concept with high-performance computing to enable rapid optimisation and customisation of next generation vehicles**

This topic addresses the necessity to develop advanced methodologies for improved design capabilities via numerical simulation, virtual and physical testing and validation of the design of different vehicle types including purpose-fit and customised vehicles. In addition, it calls for research enabling improved performance by design and the provision of new design capabilities reflecting specific requirements of automated and connected vehicles, including mechatronic systems.

### **3. Eco-design approaches integrating virtual product development and validation with flexible manufacturing**

With the aim of reducing the environmental impact by greatly increasing the efficiency in production and supply chain operations, this topic focuses on the development and application of methods for eco-design, integrating design and manufacturing in a circular economy perspective from the earliest stage of vehicle development.

### **4. New opportunities to foster research and innovation in the automotive sector through improved university-RTO-industry cooperation including education and training**

The future competitiveness of Europe depends on the availability of skilled human resources. This can be achieved through enhanced collaboration between industry and academic centres-of-excellence thanks to the widespread application of proven cooperation schemes and by promoting new education curricula.

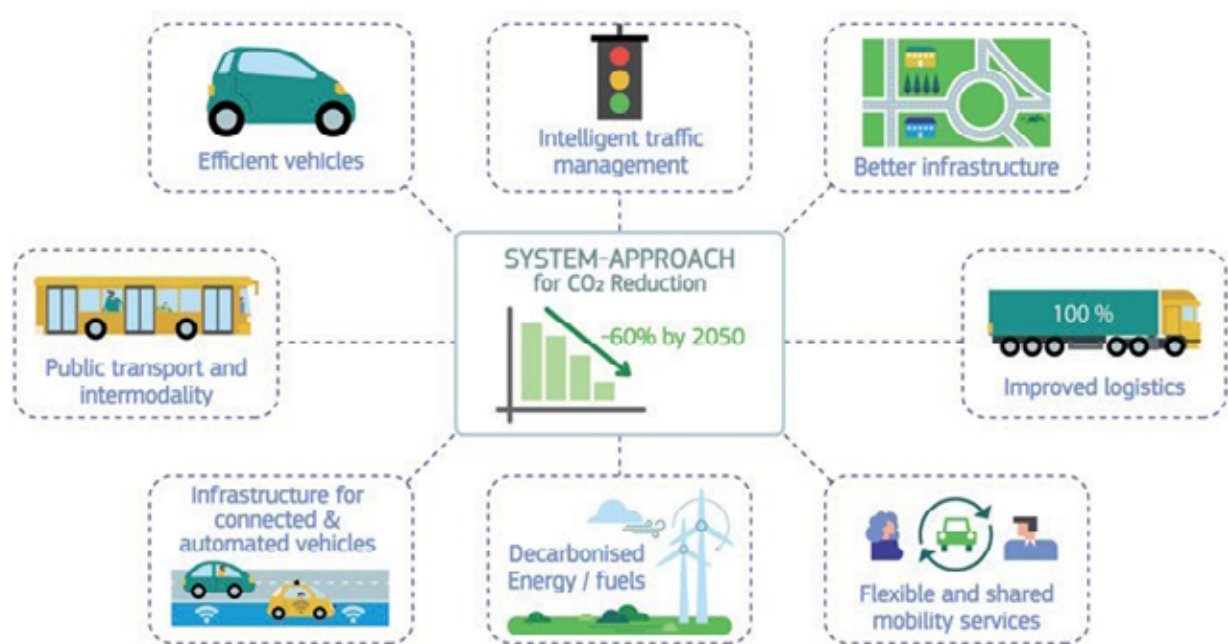
### **5. International and cross-sectorial cooperation**

The aim is to guarantee the future competitiveness of Europe, which will be achieved through a better understanding of competing markets and regions, and by identifying opportunities for cooperation and standardisation.



## TOWARDS DECARBONISATION: CO<sub>2</sub> EVALUATION

Decarbonisation is one of the main challenges for road transport. The objective, based on the EU Transport White Paper, is that, by 2050, the overall CO<sub>2</sub> (tank-to-wheel, TTW) emissions should be reduced by more than 60% of the 1990 emission levels. In a context of significantly increasing transport needs and road traffic, this ambitious target can only be reached by using all possible reduction opportunities in the transport system: more efficient vehicles, better traffic conditions and technologies to reduce traffic.



Source: ETRAC

At the TRA 2018 Conference, ETRAC published a CO<sub>2</sub> study where they collected all technologies that could be relevant by 2050 and performed an assessment, including pessimistic and optimistic values, in which the JRC calculated the CO<sub>2</sub> effect on the overall European fleet under real world driving conditions. All scenarios show clearly that electrification is the main leverage to reduce CO<sub>2</sub> (TTW), and only the fleet mix scenarios with high level of electrified vehicles show an opportunity to reach the policy objective. This means that an ambition innovation programme is needed to support the improvement of electromobility from today's technological level to a stage where all the customer needs are met, e.g. range, charging and costs.

Another important message from the study is that there will still be a significant need for chemical energy carriers, especially for long distance trips and heavy duty transport. Because the usage of these vehicles require much more energy than electric vehicles in urban use, even in highly electrified scenarios around 50% of the overall energy need will stem from road transport relying on chemical energy carriers.

Therefore, Europe needs to strengthen its activities in producing renewable energies: not only electricity but also renewable fuels like synthetic fuels, sustainable biofuels or hydrogen. Knowing that the production of renewable fuels in the quantities required will be challenging, considering also the needs from other transport modes and sectors, a further improvement of combustion engines and of road traffic conditions are key issues for future research and innovation.

## CONCLUSION

The European Funding Team of Luxinnovation offers support to all national stakeholders in their applications to Horizon 2020. Our aim is to provide strategic advice to all potential players through the whole proposal preparation process, from the concept development to the submission, and then in the management of successfully funded projects.

We offer a variety of services: i) we inform about future opportunities, both within thematic events and in more tailored, face-to-face discussions; ii) we match individual strengths with current and future calls; iii) identifying best consortia and partners; iv) we offer, thanks to our thematic experience and a long track record in EU research, a critical proposal review service; v) we identify key networks and partnership for strategic networking; vi) we support in legal and financial aspects of H2020.

We are keen to discuss about potential involvement and support, please visit our [webpage](#), or contact us directly:

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