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Joint EU Vision on R&I for the Technological Competitiveness of the EU Automotive Sector

Independent Expert Report

Joint EU Vision on R&I for the Technological Competitiveness of the EU Automotive Sector

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Joint EU Vision on R&I for the Technological Competitiveness of the EU Automotive Sector

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Scope

This document presents a joint EU vision for Research and Innovation (R&I) to enhance the technological competitiveness of the EU automotive sector. It guides the R&I dimension in the EU Action Plan for the Automotive Industry, published in 2025[1]. It was developed by a broad representation of European automotive stakeholders, in close coordination with the European Commission, and supported by the three associations representing the private side of the Horizon Europe Co-programmed Partnerships in the field of automotive, in the context of the Memorandum of Understanding (MoU) on the cooperation and collaboration to enhance the research and innovation contribution to the Industrial Action Plan for the European automotive sector signed in September 2025[2]. This plan's objective is to have a thriving automotive industry in Europe that creates jobs, drives growth, and protects the environment. Research and Innovation (R&I) has a central role in this plan, fully aligned with other immediate actions to support the EU automotive industry in this accelerated transformation.

1. Context

1.1. The Automotive Industry in Europe

The automotive industry is vital to the European economy, as it contributes approximately €1 trillion (7%) to the EU's gross domestic product. Global vehicle registrations in 2024 reached 92 million, and the fastest-growing regions for new vehicle registrations are outside the EU. Comparing import and export statistics, vehicles generated in 2024 a positive trade surplus of 94 billion Euro (export: 178 billion Euro), while for automotive components, the EU trade balance turned negative in 2025 when including batteries and electronics[3]. The automotive sector provides more than 2 million direct and 13 million indirect jobs in the EU, accounting for 8% of the EU workforce[4]. In addition to its positive impact on employment and the economy, the automotive sector is an innovation powerhouse for Europe, with multiple side effects and cross domain benefits, and the capacity to develop a large and diverse innovation ecosystem.

The sector faces increasing challenges, including high investment requirements for new technologies, growing competition from other regions, and a shifting geopolitical landscape that is impacting trade. Over the period 2018 to 2024, vehicle production in the EU fell significantly, dropping from around 16 million units in 2018 to roughly 11.4 million in 2024, a decline of almost 30%. In 2024, EU vehicle production fell by 6% for cars and 9% for commercial vehicles. Although the trade surplus remained high, it was 6% lower than in 2023[5]. Competition is intensifying, and the industry is under pressure in an increasingly unpredictable trade environment. Despite these obstacles, the automotive sector remains the leading investor in R&D, with €85 billion invested in 2023—twice as much as the next sector.

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[1] Boosting the European car sector - European Commission
[2] https://transport.ec.europa.eu/document/download/1e929ecd-eee5-4ee5-b18b-c5843d76259f_en?filename=C(2025)6157_annex.pdf
[3] https://www.clepa.eu/insights-updates/data-digests/jobs-lost-trade-in-the-red-will-europes-auto-future-be-made-elsewhere/
[4] The Automobile Industry Pocket Guide 2025/2026 - ACEA - European Automobile Manufacturers' Association
[5] https://www.acea.auto/publication/economic-and-market-report-global-and-eu-auto-industry-first-half-of-2025/

1.2. A Major Shift Is Essential

The European automotive sector is at a critical turning point, challenged by rapid technological changes and increasingly fierce competition. The green and digital transitions, driven by electrification, software-defined architectures and artificial intelligence (AI), are redefining the technological foundations of transport and the automotive industry. Technology transformations and R&D cycles are accelerating as new entrants compete by offering advanced technologies, shorter time-to-market, high levels of financing and/or lower production costs.

Current value creation in electrified vehicles has increasingly shifted towards other regions of the world, particularly in areas such as battery production, software development, and advanced electronics. To reverse this trend and secure Europe's manufacturing capacities and competitiveness, joint efforts in research and innovation are urgently needed to bring value creation back to Europe.

European technological sovereignty requires aligned investments from both public and private actors to retain and attract expertise to Europe, thereby strengthening manufacturing, jobs, and growth. The European Union must prioritise industrial needs and strategies in translating research and innovation into commercialisation. This includes developing innovations to secure global supply chains and reduce dependencies on critical materials and technologies (e.g., batteries, e-powertrain components, autonomous driving, software, AI, semiconductors, digital infrastructures), as well as scaling up manufacturing and industrial capabilities, and developing the necessary skills. Across the complex value chains in the automotive sector, innovation needs to accelerate, reducing development cycle times, from applied research to marketable products, by 40-50%. Software drives value creation by providing functions and services for mobility and transport, both within vehicles and the related infrastructure (e.g. cloud). Prioritising impact through focused investments is essential to improve the EU's competitiveness, (re)gain value creation in Europe, address societal challenges and hence ensure a better quality of life.

The technologies linked to battery development and production are also essential in catching up on the competitiveness of Europe. Not only mastering current technologies (e.g. NMC, LFP) but also leading the next generation (e.g. solid-state) and further relevant technologies (e.g. sodium-ion). R&I is required across the entire value chain to strengthen EU process capacities and scale with a focus on the cost-effective, high-performance end-user product while avoiding overly strong dependencies on critical and advanced materials. This will provide synergies and benefits to other application areas.

To address the changes ahead, President von der Leyen launched a Strategic Dialogue on the Future of the European Automotive Industry in January 2025, a collaborative and inclusive process designed to tackle the sector's most pressing challenges. The Industrial Action Plan for the European automotive sector[6] builds on the Strategic Dialogue and presents concrete actions that will ensure a robust and sustainable automotive sector and help unleash its innovative power.

"The future of cars – and the cars of the future – must be made in Europe."[7]

This is not only true for cars, but for all types of road vehicles, including commercial vehicles. The sector's transformation relies on successful market implementation and innovation across the entire ecosystem. The customer's perspective is shaping new solutions,

[6] COM(2025) 95 final
[7] https://ec.europa.eu/commission/presscorner/detail/ov/SPEECH_25_2053

services and business models. Connecting the mobility[8] and energy systems is key to leveraging synergies, supporting grid stability, and offering consumers remuneration. Society's heightened expectations with respect to more affordable, accessible and sustainable transport solutions underline the need for greater efficiency and inclusiveness while minimising environmental impact. By concretely supporting industry in the transition towards clean, digitally-empowered vehicles, the Automotive Action Plan represents a paradigm shift.

2. Our Objective: A Positive Impact on Europe

In this new reality, sustainability, energy and digital empowerment are vital for Europe's competitiveness. The transformation must be supported by strengthening Europe's industrial base, including the adaptation of the supply chains and the workforce. The automotive sector's R&I policy and investments all over Europe must be guided by their impact on the economy, environment, and society to ensure leadership across all aspects of the mobility ecosystem:

- **Economic Prosperity**: A competitive, resilient, and sovereign European automotive industry is essential to maintain prosperity. Innovation must reinforce Europe's industrial leadership and strategic autonomy in the global mobility landscape.
- **Environmental Impact**: Caring for the planet requires a cradle-to-cradle life cycle approach and the widespread adoption of the circular economy, ensuring that mobility solutions are resource-efficient and regenerative while maximising the use of renewable energy sources and eliminating air pollution.
- **Societal Impact**: Putting people first means ensuring that mobility is affordable, accessible and inclusive, serving the needs of all citizens - urban and rural population, regardless of age, physical ability or financial means. This includes a strong commitment to **Vision Zero**, aiming to eliminate road fatalities and serious injuries, while enabling safe and equitable mobility for everyone. Also required are (higher) education and focused skills development programmes to guarantee an adequately trained workforce and high-quality jobs.

"Our mutual aim is a sustainable, competitive, and innovative car industry in Europe that benefits our citizens, our economy, and our environment."[9]

Our goal: innovations that generate positive impacts across these three dimensions. Europe must aim to provide preferred options for the safest and cleanest mobility solutions for all, delivered by a robust, globally competitive and future-ready automotive sector.

3. Our Vision: Value-driven Prosperity and Growth

In reaction to intense global competition, Europe must focus without delay on securing a strong position in software-defined, hardware-enabled, electric and automated mobility. Europe must drive the transformation of today's automotive industry into tomorrow's core pillar for providing sustainable, digital and competitive road transport and mobility solutions**:** vehicle manufacturers and suppliers must join forces to strengthen EU industrial competitiveness, working to bridge the innovation gap, to develop synergies with the energy system and accelerate the market uptake of innovative products and services by prioritising the impact of all joint research and development activities. As the automotive industry enters a new era, AI is transforming how

[8] Mobility for people and goods
https://ec.europa.eu/commission/presscorner/detail/en/ip_25_635

vehicles are designed, operated, and integrated into mobility ecosystems. This enables a shift from static, rule-based systems to adaptive, data-driven architectures and decisions within verified and validated boundaries.

By 2035, thanks to an effective green and digital transformation characterised by impact, speed and agility, Europe should strive to achieve:

- Major value creation through European vehicle production and an optimised supply ecosystem, including software, hardware (i.e. automotive components and electronics) and critical materials, reshaped by advances in technology, ensuring European sovereignty, resilience and sustainability.
- Vehicles designed to provide users with a greater freedom of choice with respect to affordability, vehicle size and their intended use, while fulfilling all environmental requirements in terms of zero-emissions and circular economy as well as all safety standards.
- A robust battery product and process innovation ecosystem capable of delivering state-of-the-art technologies (including current and future battery technologies) for EU vehicle production with the ambition to compete on a global scale. This includes battery materials, production processes and machinery, also boosting other sectors, while reducing the EU's dependencies.
- Significant progress in the digital transformation of the road mobility system with Software-Defined Vehicles (SDVs) built on European open-source software and autonomous driving stacks, federated and synthetic data pooling, safety certified, EU-based software and trustworthy AI, capable of optimisation throughout their lifecycle, together with the large-scale deployment of Cooperative, Connected and Automated Mobility (CCAM).
- Seamless integration of the road transport and energy systems, with easy-to-access smart charging, offering bidirectional energy flows and providing enhanced grid stability and capacity.
- World-leading researchers, innovators, entrepreneurs and highly-skilled experts working and investing in Europe.

By 2050, the road transport and mobility system in Europe will be climate-neutral and circular, digitally-integrated and highly-efficient, safe and resilient, inclusive and affordable, characterised by:

- The successful completion of the twin electrification-digitalisation transition within a circular economy, with zero-emission all new cars, vans, buses and heavy-duty vehicles.
- A globally competitive EU automotive industry, providing vehicles and services built on green and digital innovation, guaranteeing European technological sovereignty for a future-oriented and resilient mobility ecosystem.
- Autonomous, connected and data-driven mobility services for people and goods, seamlessly integrated with other modes of transport and powered by Made-in-Europe technology.
- The achievement of 'Vision Zero': the complete elimination of fatalities and serious injuries on European roads.

This vision aligns with the key EU policies such as the Sustainable and Smart Mobility Strategy, the European Green Deal, the Clean Industrial Deal and the Digital Decade, which reflect a holistic approach where sustainability, digitalisation, and competitiveness reinforce each other.

4. Our Call: for Collective and Coordinated Action

Research and Innovation (R&I) policy and investment should not only strengthen existing assets but also support the transition from traditional automotive value chains to a broader future ecosystem: creating additional value through data, software, AI, electrification, automation, resilient supply chains (such as advanced and critical materials, semiconductors), and the circular economy. These are areas where collaborative EU-level R&I plays a crucial role, particularly by progressing mid-level Technology Readiness Levels towards deployment.

The Automotive Action Plan provides a concrete framework to address these challenges. From an R&I perspective, it focuses on digital transformation, electrification, energy integration and circular economy. Innovations and new technologies in these areas go hand-in-hand with advances in design, manufacturing and production, significantly accelerating validation, demonstration, Start of Production (SoP) and time-to-market[10]. Therefore, dedicated partnerships for specific activities[11] support the development of the joint Vision for the automotive sector.

The EU must accelerate innovation and develop a public–private investment strategy to remain globally competitive.

To deliver on this ambition, Europe must concentrate its efforts on mastering key technologies across complex value chains, ensuring that (breakthrough) innovations move beyond research projects to industrial scale-up and market deployment, in line with the European Competitiveness Fund framework, the Connecting Europe Facility (CEF) and other relevant European and national funding streams. This requires collaborative, pre-competitive innovation frameworks that link R&I excellence to industrial transition pathways. It is also essential to create new and innovative business offers and ways to build markets.

The R&I framework conditions should boost Europe's growth, employment, and competitiveness while addressing global societal challenges aligned with industry. Europe's industry and the automotive sector need fast, agile, and flexible processes embedded in R&I programmes to operate in a rapidly evolving, globally competitive environment. Simplifying and reducing administrative burdens and streamlining processes within R&I programmes to meet industrial needs will enable more efficient use of resources while supporting the participation of startups and SMEs. More cohesive budgets and focused topics enable comprehensive, integrated innovation initiatives (flagship projects) with substantial industrial participation and funding, aimed at fostering innovation, creating lasting collaborations and shaping European standards for global use. Lastly, scaling up our ambitions in software and batteries requires significant private investments, supported through funding instruments. More agile funding processes and increased flexibility to adapt to changing realities to support competitiveness should be considered.

These efforts will feed into the upcoming EU Framework Programme for Research and Innovation (FP10), following the Industrial Action Plan[12] for the European Automotive Sector

[10] https://www.eucar.be/position-paper-the-future-automotive-partnership-joint-undertaking/
[11] such as EGVIAfor2Zero, CCAM, BEPA
[12] Commission boosts European automotive industry's global competitiveness

and the Automotive Package[13], ensuring alignment between R&I investment, industrial transformation and Europe's strategic autonomy.

5. Technological Areas to Guide the Strategic Research and Innovation Agenda (SRIA)

The clean transition and digital transformation build upon several strategic technology domains**.** It is essential to assess each domain and related technologies regarding their impact[14] on:

- **Economic Impact** – strengthening competitiveness, resilience, strategic autonomy and value creation
- **Environmental Impact** – achieving sustainability, resource efficiency, energy system integration, and climate goals
- **Societal Impact** – providing safety, security, jobs, affordability, quality of life & clean air accessibility, and inclusion

The technology areas outlined in this chapter provide a starting point for guiding the SRIA development. Further work will be needed to elaborate, complete and finalise each area description.

Clean Mobility

- Vehicle application-oriented batteries: e.g. advanced performance cell chemistries and materials, cost-optimised cell chemistries and materials, innovative manufacturing processes and scale-up, system integration and vehicle application.
- Electrified powertrains: e.g. more efficiency, cost reduction, including technologies substituting critical materials, improved durability and lightweight solutions, predictive maintenance.
- Power Electronics Systems: e.g. high-efficiency, compact, and cost-effective inverters, converters, and controllers; integration of wide-bandgap and ultra-wide-bandgap semiconductors (SiC, GaN, …) for enhanced performance.
- Electromobility charging ecosystem: e.g. V2G-ready vehicles and infrastructure, effective charging infrastructure and the energy ecosystem integration,
- Circular economy, recycling, remanufacturing and reuse: e.g. energy- resource- and cost-efficient design and processes in a circular economy, materials innovations, recycling for automotive batteries and critical components.
- AI-driven, flexible, and automated design, development, validation and production tools/systems to reduce time to market: AI-supported modelling from materials to system development, AI in processes to improve quality and scaling in production.

Digital and Connected Mobility

- Software-Defined Vehicles: e.g. hardware abstraction, open-source, non-differentiating Software and hardware building blocks, interfaces and tools, trustworthy reasoning-capable chips promoting AI-based vehicle stacks, ensuring safety, security and energy efficiency.

[13] Automotive package - Mobility and Transport - European Commission
[14] and where relevant, the systemic interrelation of impacts

- System engineering for connected and automated vehicles and AI-defined vehicles: e.g. Standard Development Kits, toolchains, and automated functionalities for SW creation and delivery, ADS and ADAS systems and components for 'sense, think, act', as well as HMI.
- Integrating AI models, agents and toolchains in automotive products, and in particular in automated and autonomous driving functions.
- Road Safety with automation: integrating safety by design in future motor vehicles.
- Innovative data acquisition for AI development: e.g. for testing and validation frameworks, synthetic data, federated learning, data pooling/sharing.
- V2X communication and intelligent infrastructures, including cybersecurity and resilience.

Accelerating Innovation in Mobility Flagships (initiatives defined by the Industrial Stakeholders, tbc in Industrial Steering Forum)

- Demonstrations and large-scale pilot initiatives and business-to-business demonstrators.
- Pilot- lines, manufacturing processes and scale-up: resilience and supply chain security, equipment manufacturing for production.
- Complementary regulatory and experimental measures for sandboxes to foster innovation.
- Innovative service and market creation offers for passenger and freight transportation with commercial vehicles, enabling seamless, efficient, multimodal and sustainable operations leveraged by clean, connected and automated vehicles.
- Integrating AI into vehicles and each development stage (vehicle design, research, development, validation, production and manufacturing) to accelerate innovation cycles.

The proposed instruments should directly drive ambitious R&I activities in areas critical to the future of the automotive industry, including but not limited to the above areas. Fragmentation must be avoided by fully aligning all relevant initiatives to boost R&I for the technological competitiveness of the EU automotive sector across Europe, including the European Connected and Autonomous Vehicles Alliance, large-scale cross-border testbeds for autonomous driving, Autonomous Drive Ambition Cities under the Apply AI strategy[15], innovative regulatory 'sandboxes', IPCEI initiatives, European, national and regional research and innovation programmes in road transport.

[15] https://digital-strategy.ec.europa.eu/en/news/first-european-connected-and-autonomous-vehicle-alliance-meeting-paves-way-ambitious-industrial

Annex: Contributors to this report

This document was developed by a broad representation of European automotive stakeholders, in close coordination with the relevant European Commission services (in particular Directorate-General Research and Innovation/DG RTD, and Directorate-General Mobility and Transport/DG MOVE), supported by the three associations representing the private side of the Horizon Europe Co-programmed Partnerships “Towards zero emission road transport partnership” (2ZERO), “Connected Cooperative Automated Mobility” (CCAM) and “European Partnership for Batteries” (Batt4EU). The document was also subject to a consultation with all relevant European Associations acting in the automotive sector.

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