European Commission

Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

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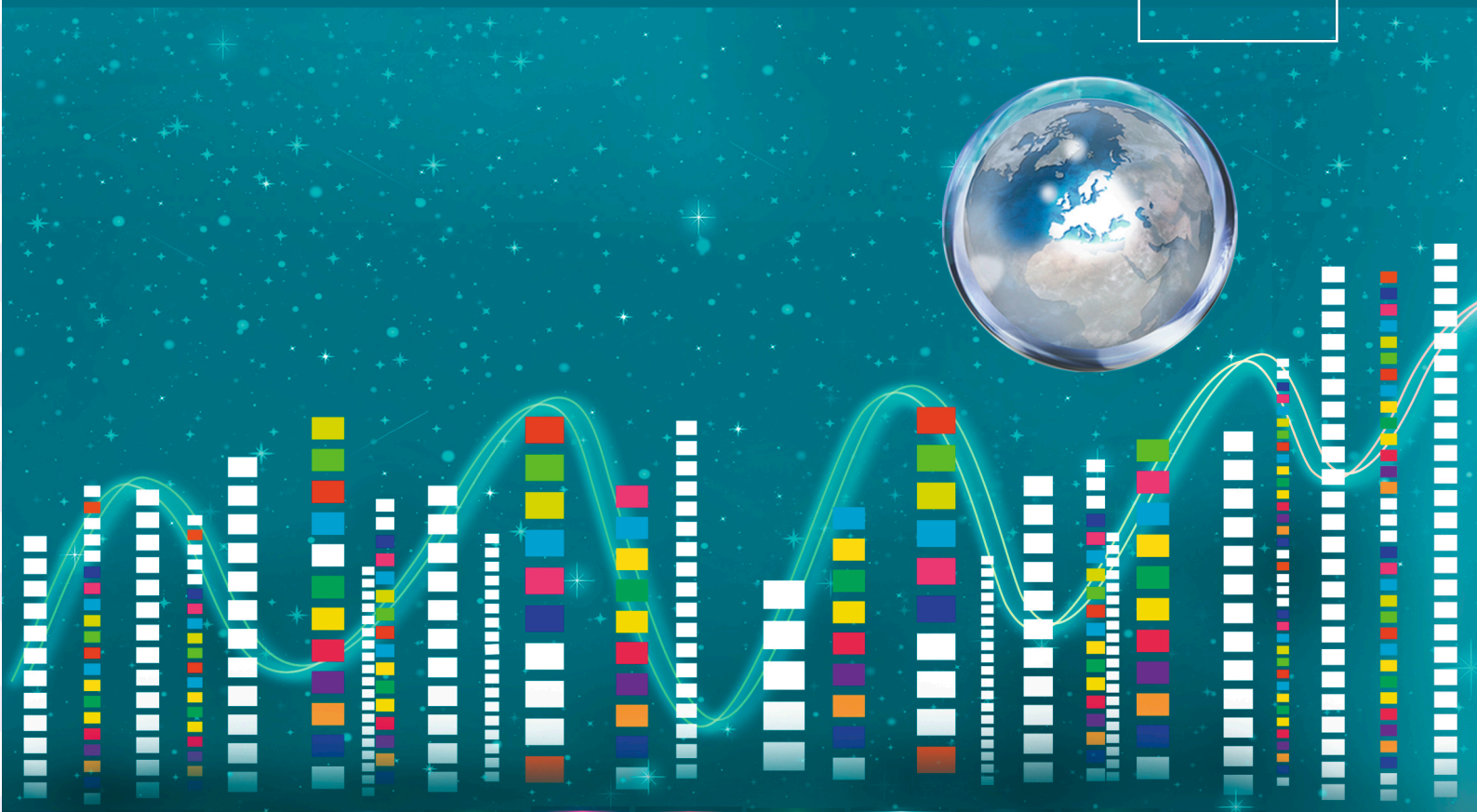
Report



Research and Innovation

Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

European Commission
Directorate-General for Research and Innovation
Directorate A — Policy & Programming Centre
Unit A.2 — Programme Analysis & Regulatory Reform
Contact Ann-Sofie Ronnlund
Email RTD-A2-SUPPORT@*ec.europa.eu*
Ann-Sofie.Ronnlund@*ec.europa.eu*
RTD-PUBLICATIONS@ec.europa.eu
European Commission
B-1049 Brussels

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Impact Assessment Study for Institutionalised European Partnerships under Horizon Europe

In collaboration with

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Introduction

This Impact Assessment Study had the primary objective to support and provide input to the impact assessments of the first set of 13 European Institutionalised Partnerships based on Articles 185 and 187 of the Treaty on the Functioning of the EU (TFEU) that are envisaged to be funded under the new Framework Programme for Research and Innovation, Horizon Europe.

In addition, the Impact Assessment Study team contributed to future European policymaking on the overall European Partnership landscape by means of a horizontal analysis of the coherence and efficiency in the implementation of European partnerships. The purpose of this analysis was to draw the lessons learned from the implementation of the impact assessment methodology developed for this study and to formulate recommendations for the refinement and operational design of the criteria for the selection, implementation, monitoring, evaluation and phasing-out for the three types of European Partnerships. Finally, an impact modelling exercise was conducted in order to estimate the potential for longer-term future impacts of the candidate Institutionalised European partnerships in the economic and environmental sustainability spheres.

Technopolis Group was responsible for the overall coordination of the 13 specific impact assessment studies, the development of the common methodological framework, and the delivery of the horizontal analysis. It also conducted specific analyses that were common to all studies, acting as a 'horizontal' team, in collaboration with CEPS, IPM, Nomisma, and Optimat Ltd. For the implementation of the individual impact assessment studies, Technopolis Group collaborated with organisations that are key experts in specific fields covered by the candidate Institutionalised European Partnerships. These partner organisations were Aecom, Idate, Steer, Think, and Trinomics. Cambridge Econometrics took charge of the impact modelling exercise.

The Impact Assessment Study was conducted between July 2019 and January 2020. The 13 Impact Assessment Studies were conducted simultaneously, based upon a common methodological framework in order to maximise consistency and efficiency. The meta-framework reflected the Better Regulation Guidelines and operationalised the selection criteria for European Partnerships set out in the Horizon Europe Regulation. The 'Horizontal analysis of efficiency and coherence of implementation' was conducted in the same time period, building upon the information available on the 44 envisaged European Partnerships landscape as in May 2019, complemented with information on five envisaged European Partnerships as decided by the European Commission in October and November 2019.

This final report contains the reports of all individual impact assessment studies and the 'horizontal' analyses. It is structured in two parts, reflecting the two strands of analysis:

PART I. Impact Assessment Studies for the Candidate Institutionalised European Partnerships

1. Overarching context to the impact assessment studies

This report sets out the overall policy context and methodological framework underlying the impact assessment studies for the candidate Institutionalised European Partnerships. It describes the changes in approach to the public-private and public-public partnerships under Horizon Europe compared to the previous EU Framework Programmes. An example is the requirement that all envisaged European Partnerships be implemented as either co-programmed, co-funded or institutionalised. The impact assessment studies will consider these three scenarios as the different options to be assessed, in compliance with the Better Regulation guidelines and against the functionalities that the candidate partnerships are expected to fulfil. The report describes the common methodological framework to assess the envisaged initiatives accordingly. The report also presents the landscape of European Partnerships at the level of Horizon Europe Pillar 2 clusters, which lay the grounds for all

of the impact assessment studies except the candidate Institutionalised European Partnership for Innovative SMEs.

2. EU-Africa Global Health Candidate Institutionalised European Partnership

This initiative focuses on research and innovation in the area of infectious diseases, with a particular focus on sub-Saharan Africa. It will address the challenges of a sustained high burden of infectious diseases in Africa, as well as the (re)emergence of infectious diseases worldwide. Its objectives will thus be to contribute to a reduction of the burden of infectious diseases in sub-Saharan Africa and to the control of (re)emerging infectious diseases globally. It will do so through investments in relevant research and innovation actions, as well as by supporting the further development of essential research capacity in Africa. The study concluded that an Institutionalised Partnership under Art. 187 of the TFEU is the preferred option for the implementation of this initiative.

3. Candidate Institutionalised European Partnership on Innovative Health

This initiative focuses on supporting innovation for health and care within the EU. It will address the EU-wide challenges raised by inefficient translation of scientific knowledge for use in health and care, insufficient innovative products reaching health and care services and threats to the competitiveness of the health industry. Its main objectives are to create an EU-wide health R&I ecosystem that facilitates translation of scientific knowledge into innovations; foster the development of safe, effective, patient-centred and cost-effective innovations that respond to strategic unmet public health needs currently not served by industry; and drive cross-sectoral health innovation for a globally competitive European health industry. The study concluded that an Institutionalised Partnership based on Article 187 of the Treaty on the Functioning of the EU (TFEU) is the preferred option for the implementation of this initiative.

4. Candidate Institutionalised European Partnership in High Performance Computing

The initiative focuses on coordinating efforts and resources in order to deploy a European HPC infrastructure together with a competitive innovation ecosystem in terms of technologies, applications, and skills. It will address the challenges raised by underinvestment, the lack of coordination between the EU and MS, fragmentation of instruments, technological dependency on non-EU suppliers, unmet scientific demand, and weaknesses in the endogenous HPC supply chain. The initiative has as its main objectives to enhance EU research in terms of HPC and related applications, continued support for the competitiveness EU HPC industry, and fostering digital autonomy in order to ensure long-term support for the European HPC ecosystem as a whole. The study concluded that an Institutionalised Partnership is the preferred option for the implementation of this initiative as it maximises benefits in comparison to the other available policy options.

5. Candidate Institutionalised European Partnership in Key Digital Technologies

This initiative focusses on enhancing the research, innovation and business value creation of European electronics value chains in key strategic market segments in a sustainable manner to achieve technological sovereignty and ultimately make European businesses and citizens best equipped for the digital age. It will address the risks of Europe losing the lead in critical industries and services and emerging KDTs. It will also tackle Europe's limited control over digital technologies that are critical for EU industry and citizens. It has as main objectives to strengthen KDTs which are critical for the competitive position of key European industries in the global markets, to establish European leadership in emerging technologies with high socioeconomic potential and to secure Europe's technological sovereignty to maintain a strong and globally competitive presence in KDTs. The study concluded that the Institutionalised Partnership is the preferred option for the implementation of this initiative.

6. Candidate Institutionalised European Partnership in Smart Networks and Services

This initiative focuses on the development of future networks infrastructure and the associated services. This includes bringing communication networks beyond 5G and toward 6G capabilities, but also the development of the Internet of Things and Edge Computing technologies. It will address the challenges raised by Europe delay in the deployment of network infrastructure and failure to fully benefit from the full potential of digitalisation. It has as main objective to ensure European technological sovereignty in future smart networks and digital services, to strengthen the uptake of digital solutions, and to foster the development of digital innovation that answers to European needs and that are well aligned with societal needs. The study concluded that an institutionalised partnership under article 187 is the preferred option for the implementation of this initiative.

7. Candidate Institutionalised European Partnership in Metrology

This initiative focuses on metrology - that is the science of measurement and the provision of the technical infrastructure that underpins accurate and robust measurements throughout society; measurements that underpin all domains of science and technology and enable fair and open trade and support innovations and the design and implementation of policy and regulations. It will address challenges in the fragmentation of national metrology systems across Europe and the need to meet ever-increasing demands on metrology infrastructure to support the measurement needs of emerging technologies and important policy domains in climate, environment, energy and health. The main objective of the initiative is to establish a sustainable coordinated world-class metrology system in Europe that will increase and accelerate the development and deployment of innovations and contribute to the design and implementation of policy, regulation and standards. The study concluded that an A185 Institutionalised Partnership is the preferred option for the implementation of this initiative.

8. Candidate Institutionalised European Partnership on Transforming Europe's Rail System

This initiative focuses on the development of a pan-European approach to research and innovation in the rail sector. It will address the challenges raised by the lack of alignment of research and innovation with the needs of a competitive rail transport industry and the consequent failure of the European rail network to make its full contribution to European societal objectives. It will also strengthen the competitiveness of the European rail supply industry in global markets. Accordingly, the objectives of the initiative are to ensure a more market-focused approach to research and innovation, improving the competitiveness and modal share of the rail industry and enhancing its contribution to environmental sustainability as well as economic and social development across the European Union. The study concluded that an institutionalised partnership under article 187 is the preferred option for the implementation of this initiative.

9. Candidate Institutionalised European Partnership for Integrated Air Traffic Management

This initiative focuses on the modernisation of the Air Traffic Management in Europe - an essential enabler of safe and efficient air transport and a cornerstone of the European Union's society and economy. The proposed initiative will address the challenges raised by an outdated Air Traffic Management system with a non-optimised performance. The current system needs to be transformed to enable exploitation of emerging digital technologies and to accommodate new forms of air vehicle including drones. The objective is therefore to harmonise European Air Traffic Management system based on high levels of digitalisation, automation and connectivity whilst strengthening air transport, drone and ATM markets competitiveness and achieving environmental, performance and mobility goals. This would create €1,800b benefits to the EU economy if the current initiative can

be built on and accelerated. The study concluded that an Institutionalised Partnership under Art. 187 TFEU is the preferred option for the implementation of this initiative.

10. Candidate Institutionalised European Partnership on Clean Aviation

This imitative focuses on further aeronautical research and innovation to improve technology leading to more environmentally efficient aviation equipment. It will address the challenges raised by the growing ecological footprint of aviation and the challenges and barriers faced by the aviation industry towards climate neutrality. It will also strengthen the competitiveness of the European aeronautical industry in global markets. Accordingly, the objectives of the initiative are to ensure that aviation reaches climate neutrality and that other environmental impacts are reduced significantly by 2050, maintain the leadership and competitiveness of the European aeronautics industry and ensure safe, secure and efficient air transport of passengers and goods. The Impact Assessment study assessed the options for implementation that would allow for an optimal attainment of these objectives. The study concluded that an institutionalised partnership under Art. 187 TFEU is the preferred option for the implementation of this initiative.

11. Candidate Institutionalised European Partnership on Clean Hydrogen

The report assesses the impact of potential initiatives to support, through research and innovation, the growth and development of clean hydrogen, among which an Institutionalised European Partnership is one of the options assessed. The existing challenges for clean hydrogen include the limited high-level scientific capacity and fragmented research activities, the insufficient deployment of hydrogen applications, and consequently weaker EU scientific and industrial value chains. Environmental, health and mobility pressures are also driving the need for cleaner hydrogen generation, deployment and use. An initiative for clean hydrogen must have as a main objective the strengthening and integration of EU scientific capacities, to support the creation, capitalisation and sharing of knowledge. This is necessary to accelerate the development and improvement of advanced clean hydrogen applications, the market entry of innovative competitive clean solutions, to strengthen the competitiveness of the EU clean hydrogen value chains (and notably the SMEs within them), and to develop the hydrogen-based solutions necessary to reach climate neutrality in the EU by 2050. The study concluded that an Institutionalised Partnership under Art. 187 TFEU is the preferred option for the implementation of this initiative.

12. Candidate Institutionalised European Partnership on Safe and Automated Road Transport

This initiative focuses on Connected, Cooperative and Automated Mobility: the use of connected and automated vehicles to create more user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation. With current road traffic collisions and negative local and global environmental impacts not reducing quickly enough, it will address the challenges raised by the current fragmentation of research across the field, and the threat to European competitiveness if the research agenda does not advance quickly enough. The initiative will focus on strengthening EU scientific capacity and economic competitiveness in the field of CCAM, whilst contributing to wider societal benefits including improved road safety, less environmental impact, and improved accessibility to mobility. The study concluded that a co-programmed partnership is the preferred option for the implementation of this initiative.

13. Candidate Institutionalised European Partnership for a Circular Bio-based Europe

This initiative focuses on intensifying research and innovation allowing to replace, where possible, non-renewable fossil and mineral resources with biomass and waste for the production of renewable products and nutrients, in order to drive forward sustainable and climate-neutral solutions that accelerate the transition to a healthy planet and respect

planetary boundaries. It will address the challenges raised by the fact that the EU economy does not operate within planetary boundaries, is not sufficiently circular and is predominantly fossil based. It will also address the insufficient research and innovation (R&I) capacity and cross-sectoral transfer of knowledge and bio-based solutions, as well as risks posed to the European bio-based industry's global competitiveness. The study concluded that Institutionalised European Partnership based upon Article 187 TFEU is the preferred option for the implementation of this initiative.

14. Candidate Institutionalised European Partnership for Innovative SMEs

The initiative is envisaged as a continuation of the Eurostars 2 programme which is managed by the Eureka network. The initiative focuses on international collaborative R&D of innovative companies, facilitated through a network of national funding organisations as included in the Eureka network. The funded projects are bottom-up and involve small numbers of project partners. The candidate partnership addresses a niche issue namely limited opportunities for international bottom-up collaboration. The partnership provides thus an opportunity for SMEs for international R&D collaboration but does not address specific technological, social, or environmental challenges. Its main objective is to improve the competitiveness of European SMEs through collaborative funding. The study concluded that a co-funded partnership is the preferred option for the implementation of this initiative.

PART II. Horizontal studies

1. Horizontal Analysis of Efficiency and Coherence in Implementation

The focus of this report is on the coherence and efficiency in the current European Partnership landscape under Horizon Europe and the potential to enhance efficiency in the European Partnerships' implementation.

European Partnerships are geared towards playing a pivotal role in tackling the complex economic and societal challenges that constitute the R&I priorities of the Horizon Europe Pillar II and are in a unique position to address transformational failures. Multiple potential interconnections and synergies exist between the candidate European Partnerships within the clusters, but few are visible across the clusters.

As for the improvement of the efficiency in implementation of institutionalised partnerships under Art. 187, potential efficiency and effectiveness gains could be achieved with enhanced collaboration. An option for a common back-office sharing operational implementation activities is worth exploring further through a detailed feasibility study in order to assess whether efficiency gains can be made. Ideally this would be co-designed as a common Partnership approach, leading to a win-win situation for all partners.

2. Impact Modelling of the Candidate Institutionalised European Partnerships

This report presents the results of the use of a macroeconomic model to assess the economic and environmental impacts of the preferred options identified in the individual 13 impact assessment studies. The model used is E3ME. It includes explicit representation for each EU Member State with a detailed sectoral disaggregation.

The impact modelling estimated the impacts of the envisaged initiatives at an aggregated as well as individual level. In total, 14 macroeconomic models have been run, one per reviewed initiative with a time horizon of 2035 and one that combines all initiatives with a time horizon of 2050. The results of each of these models were compared with those of a baseline scenario, which corresponds to a situation where the initiatives would be funded through regular Horizon Europe calls rather than European Partnerships.

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Part I. Impact Assessment Studies for the Candidate Institutionalised European Partnerships

1. Overarching Context to the Impact Assessment Studies

Authors

Bea Mahieu, Paul Simmonds, Maria del Carmen Calatrava, Julien Chicot, Diogo Machado, Stijn Zegel (Technopolis Group)

Andrea Renda (CEPS)

2020 Directorate-General for Research and Innovation EN

Introduction

This report sets out the overall policy context of the impact assessment studies for the candidate Institutionalised European Partnerships and the methodological framework that was developed for the impact assessment studies.

It describes the changes in approach to the public-private and public-public partnerships under Horizon Europe compared to the previous EU Framework Programmes. An example is the requirement that all envisaged European Partnerships be implemented as either co-programmed, co-funded or institutionalised. The impact assessment studies will consider these three scenarios as the different options to be assessed, in compliance with the Better Regulation guidelines and against the functionalities that the candidate partnerships are expected to fulfil. The report describes the common methodological framework to assess the envisaged initiatives accordingly.

The report also presents the landscape of European Partnerships at the level of Horizon Europe Pillar 2 clusters, which lay the grounds for all of the impact assessment studies except the candidate Institutionalised European Partnership for Innovative SMEs. This analysis is presented in more depth in the report on the 'Horizontal analysis of efficiency and coherence of implementation' in Part II of the Impact Assessment Study report.

The report is structured around two main headings:

- Chapter 1: Background and context to European Partnerships in Horizon Europe and focus of the impact assessment– What is decided
- Chapter 2: The Candidate European Partnerships under Horizon Europe – What needs to be decided

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1 Background and context to European Partnerships in Horizon Europe and focus of the impact assessment– What is decided

1.1 The political and legal context

1.1.1 Shift in EU priorities and Horizon Europe objectives

Horizon Europe is to be set in the broader context of the pronounced **systemic and holistic approach** taken to the design of the new Framework Programme and the overarching Multi-annual Financial Framework (MFF) 2021-27.

The future long-term budget will be a budget for the Union's priorities. In her Political Guidelines for the next European Commission 2019 – 2024, the new President of the European Commission put forward six overarching priorities for the next five years, which reach well beyond 2024 in scope: A European Green Deal; An economy that works for people; A Europe fit for the Digital Age; Protecting our European way of life; A stronger Europe in the world; and A new push for European democracy. These priorities build upon A New Strategic Agenda for 2019–2024, adopted by the European Council on 20 June 2019, which targets similar overarching objectives. Together with the United Nations Sustainable Development Goals (SDGs), they will shape future EU policy responses to the challenges Europe faces and will steer the ongoing transitions in the European economy and society,

The MFF 2021-27 strives to provide a framework that will ensure a more coherent, focused and transparent response to Europe's challenges. A stronger focus on European added value, a more streamlined and transparent budget, more flexibility in order to respond quickly and effectively to unforeseen demands, and above all, an effective and efficient implementation are among the key principles of the MFF. The objective is to strengthen the alignment with Union policies and priorities and to simplify and reform the system in order to "unlock the full potential of the EU budget" and "turn ambitions into reality". Investment from multiple programmes is intended to combine in order to address key crosscutting priorities such as the digital economy, sustainability, security, migration, human capital and skills, as well as support for small businesses and innovation.[1]

These principles underlying the MFF 2021-27 are translated in the intent for Horizon Europe "to play a vital role, in combination with other interventions, for creating new solutions and fostering innovation, both incremental and disruptive." [2] The new Framework Programme finds its rationale in the daunting challenges that Europe is facing, which call for "a radical new approach to developing and deploying new technologies and innovative solutions for citizens and the planet on a scale and at a speed never achieved before, and to adapting our policy and economic framework to turn global threats into new opportunities for our society and economy, citizens and businesses."

In the Orientations towards the first Strategic Plan for Horizon Europe, the need strategically to prioritise and "direct a substantial part of the funds towards the areas where we believe they will matter the most" is emphasised. The Orientations specify, "Actions under Pillar II of Horizon Europe will target only selected themes of especially high impact that significantly contribute to delivering on the political priorities of the Union."

Figure 1, below, which gives an indicative overview of how the EU political priorities are supported under Horizon Europe, shows the major emphasis placed on contributing to the priority 'A European Green Deal', aimed at making Europe the first climate-neutral

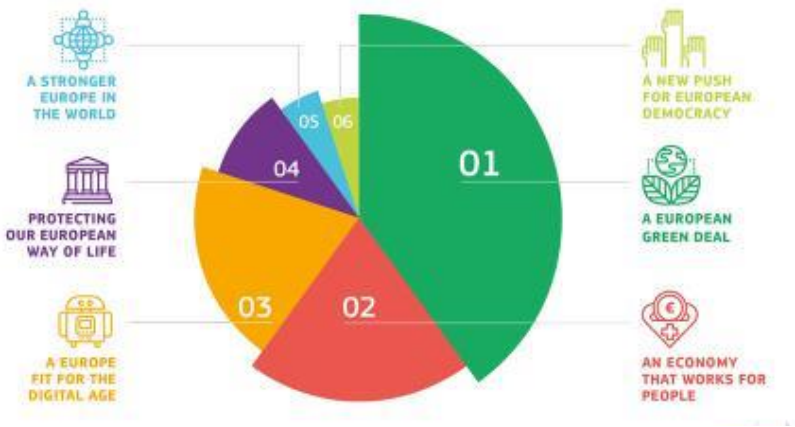
[1] EC (2018) *A Modern Budget for a Union that Protects, Empowers and Defends. The Multiannual Financial Framework for 2021-2027*. Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2018) 321 final

[2] EC (2019), *Orientations towards the first Strategic Plan for Horizon Europe*.

continent in the world. At least 35 % of the expenditure from actions under the Horizon Europe Programme will address the Sustainable Development Goal 13: Climate Action.

Especially the R&I activities funded under Pillar II, including seven Partnership Areas (see below), are expected to contribute to the attainment of these objectives in an interconnected manner.

Figure 1: Targeted impacts under Horizon Europe by priority



Note: Preliminary, as described in the General orientations towards the first Strategic Plan implementing Horizon Europe.
Source: European Commission (2019) Orientations towards the first Strategic Plan for Horizon Europe, December 2019.

1.1.2 Renewed ambition for European Partnerships

Reflecting its pronounced systemic nature aimed at 'transformation' of the European R&I system, Horizon Europe intends to make a more effective use of these partnerships with an **ambitious approach** that is impact oriented and ensures complementarity with the Framework Programme. The **rationalisation** of the partnership landscape, both in terms of number of partnership forms and individual initiatives, constituted a first step in the direction of the strategic role that these policy initiatives are expected to play in the context of Horizon Europe. Future partnerships are expected to "provide mechanisms to consistently aggregate research and innovation efforts into more effective responses to the policy needs of the Union".[3] The expectation is that they will act as **dynamic change agents**, strengthening linkages within their respective ecosystems and with other related ecosystems as well as pooling resources and efforts towards the common objectives in the European, national and regional landscape. They are expected to develop *close synergies* with national and regional programmes, bring together a *broad range of actors* to work towards a common goal, translate *common priorities* into concrete roadmaps and coordinated activities, and turn research and innovation into *socio-economic results and impacts*.

The exact budget dedicated to European Partnerships under Horizon Europe will be agreed only upon decisions on the multiannual financial framework (MFF) 2021-2017 and the overall budget for Horizon Europe. In December 2017, the Council nevertheless introduced the principle of a "possible capping of partnership instruments in the FP budget".[4] Accordingly, it reached the common understanding, with the European Parliament, that "the majority of the budget in Pillar II [€52.7bn] shall be allocated to actions outside of

[3] European Commission (2019) *Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe*. Co-design via web open consultation. Summer 2019.

[4] Council of the European Union (2017) *From the Interim Evaluation of Horizon 2020 towards the ninth Framework Programme*. Council conclusions 15320/17.

European Partnerships" (Article 8.2(a) of the Common Understanding on the proposal for a regulation establishing Horizon Europe).[5]

1.1.3 Key evolutions as regards the partnership approach

The European R&I partnerships were initially conceived as a means to increase synergies between the European Union and the Member States (Article 181 of the Treaty on the Functioning of the European Union TFEU). Their objectives were to pool the forces of all the relevant actors of R&I systems to achieve breakthrough innovations; strengthen EU competitiveness; and, tackle major societal challenges. The core activities of the European partenrships consist therefore of building critical mass mainly through collaborative projects, jointly developing visions, and setting strategic agendas. They help accelerate the emergence of a programming approach in European R&I with the involvement of all relevant actors and provide flexible structures for partnerships that can be tailored to their goals.[6]

In the consecutive Framework Programmes up to the current Horizon 2020, the partnerships and their forms have mushroomed, leading to an increasing complexity of the partnership landscape. The Horizon 2020 interim evaluation highlighted that the overall landscape of EU R&I funding had become overly complex and fragmented, and a need to improve the partnerships' openness and transparency. The Lamy report suggested that the European Partnerships should focus on those areas with the greatest European Added Value, contribute to EU R&I missions and would need a simplified and flexible co-funding mechanism.

The Competitiveness Council conclusions of December 2017 called on the Commission and the Member States to jointly consider ways to rationalise the EU R&I partnership landscape. In 2018, the ERAC Ad-hoc Working Group on Partnerships concluded, "the rationalisation of the R&I partnership landscape is needed in order to ensure that the portfolio of R&I partnerships makes a significant contribution to improving the coherence, functioning and quality of Europe's R&I system and that the individual initiatives are able to fully achieve their potential in creating positive scientific and socio-economic impacts and/or in addressing societal challenges".

Horizon Europe has taken on board these concerns. The Impact Assessment of Horizon Europe gave a clear analysis of the achievements of Partnerships so far as well as the expectations for the new generation of Partnerships. Greater transparency and openness of the partnerships were considered as essential, as well a clear European added value and long-term commitments of the stakeholders involved.

A list of criteria to decide how European Partnerships will be selected, implemented, monitored, evaluated and phased-out was attached as an Annex III to the proposal to establish Horizon Europe (as revised by the partial political agreement). The rationalisation of the Partnership portfolio in Horizon Europe is expected to allow for a reduction from the current 120 to between 45 and 50 partnerships.

[5] Council of the European Union (2019) *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rule for participation and dissemination*. Common understanding 7942/19.

[6] European Commission (2011) Partnering in Research and Innovation. Communication from the Commission COM(2011) 572 final.

1.1.4 Overview of legal provisions

The Horizon Europe Regulation (common understanding) defines 'European Partnership' as "an initiative where the Union, prepared with early involvement of Member States and/or Associated Countries, together with private and/or public partners (such as industry, universities, research organisations, bodies with a public service mission at local, regional, national or international level or civil society organisations including foundations and NGOs), commit to jointly support the development and implementation of a programme of research and innovation activities, including those related to market, regulatory or policy uptake." It stipulates that "parts of Horizon Europe may be implemented through European Partnerships".

The Horizon Europe Regulation (common understanding) also stipulates that the European Partnerships are expected to adhere to the "principles of Union added value, transparency, openness, impact within and for Europe, strong leverage effect on sufficient scale, long-term commitments of all the involved parties, flexibility in implementation, coherence, coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives or other partnerships and missions." The provisions and criteria set out for the selection and implementation of the European Partnerships reflect these principles.

1.1.5 Overview of the eight Partnership areas

The Horizon Europe Regulation also identifies the following "Areas for possible institutionalised European Partnerships on the basis of Article 185 TFEU or Article 187 TFEU":

- Partnership Area 1: Faster development and safer use of health innovations for European patients, and global health.
- Partnership Area 2: Advancing key digital and enabling technologies and their use, including but not limited to novel technologies such as Artificial Intelligence, photonics and quantum technologies.
- Partnership Area 3: European leadership in Metrology including an integrated Metrology system.
- Partnership Area 4: Accelerate competitiveness, safety and environmental performance of EU air traffic, aviation and rail.
- Partnership Area 5: Sustainable, inclusive and circular bio-based solutions.
- Partnership Area 6: Hydrogen and sustainable energy storage technologies with lower environmental footprint and less energy-intensive production.
- Partnership Area 7: Clean, connected, cooperative, autonomous and automated solutions for future mobility demands of people and goods.
- Partnership Area 8: Innovative and R&D intensive small and medium-sized enterprises.

Considering the realm of these partnership areas, potential synergies exist with the future **missions**. Horizon European introduced these cross-discipline and cross-sector policy instruments as part of its core objective of stimulating further excellence-based and impact-driven R&I. In contrast with the challenges targeted in Horizon 2020, the missions aim at the achievement of well-defined goals to provide solutions, within a specified timeframe, to scientific, technological, economical and/or societal problems. As part of the preparation of Horizon Europe, the European Commission set up five boards to formulate the future missions in the following areas:

- Adaptation to climate change including societal transformation

- Cancer
- Healthy oceans, seas, coastal and inland waters
- Climate-neutral and smart cities
- Soil health and food

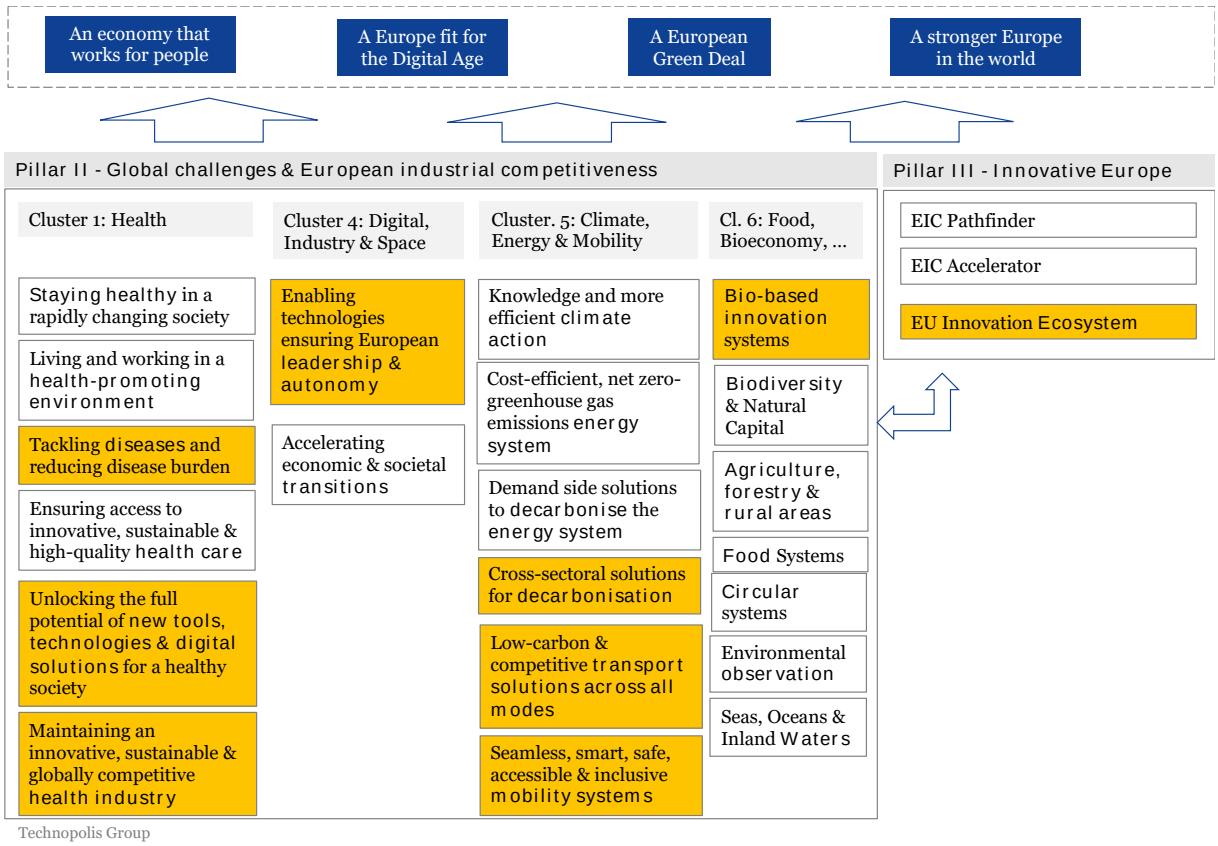
1.2 Typical problems and problem drivers

The European Partnerships are integral part of the framework programme and its three-pillar structure. They are predominantly funded under Pillar 2 "Global Challenges and European industrial competitiveness" and four of its thematic clusters. These clusters cover sectors and technologies, in which research and innovation activities are deemed of crucial importance in solving pressing scientific, societal or economic challenges and ensuring the scientific, technological and industrial leadership of Europe. Only one European Partnership, targeting innovative and R&D intensive SMEs, will instead act under Pillar 3 "Innovative Europe".

The European Partnerships are intended to contribute to the attainment of the pillars' and clusters' **challenges and R&I priorities**. Overarching EU policy priorities addressed are predominantly the European Green Deal, a people-centred economy, the fit for the Digital Age, and a stronger Europe in the world.

In Figure 2, below, the R&I priorities in the Pillars II and III to which the candidate *Institutionalised* Partnerships intend to contribute are highlighted in yellow.

Figure 2: Contribution of Candidate European Institutionalised Partnerships to the Horizon Europe priorities in Pillars II and III



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The European Partnerships under Horizon Europe most often find their rationale in addressing **systemic failures**. Their primary function is to create a platform for a strengthened collaboration and knowledge exchange between various actors in the European R&I system and an enhanced coordination of strategic research agenda and/or R&I funding programmes.

The concentration of efforts and resources and pooling of knowledge, expertise and skills on common priorities in a view of solving complex and multi-faceted societal and economic challenges is at the core of these initiatives. Enhanced cross-disciplinary and cross-sectoral collaboration and an improved integration of value chains and ecosystems are among the key objectives of these policy instruments. In the light of Horizon Europe, the aim often is to drive system transitions and transformations.

Especially in fast-growing technologies and sectors such as ICT, the envisaged European Partnerships also react on emerging opportunities and address systemic failures such as shortage in skills or critical mass or cross-sectoral cooperation along the value chains that would hamper attainment of future European leadership and/or strategic autonomy.

Transformational failures addressed aim at reaching a better alignment of the strategic R&I agenda and policies of public and private R&I funders in order to pool available resources, create critical mass, avoid unnecessary duplication of research and innovation efforts, and leverage sufficiently large investments where needed but hardly achievable by single countries.

Market failures are less commonly addressed and relate predominantly to enhancing industry investments thanks to the sharing of risks.

1.3 Description of the options

The proposal for a regulation establishing Horizon Europe[7] stipulates that parts of the Horizon Europe Framework Programme may be implemented through European Partnerships and establishes three implementation modes: Co-programmed European Partnerships, Co-funded European Partnerships, and Institutionalised Partnerships in accordance with Article 185 TFEU or Article 187 TFEU.

1.3.1 Baseline option – Traditional calls under the Framework Programme

Under this option, strategic programming for research and innovation in the field will be done through the mainstream channels of Horizon Europe. The related priorities will be implemented through traditional calls under the Framework Programme covering a range of activities, but mainly calls for R&I and/or innovation actions. Most actions involve consortia of public and/or private actors in ad hoc combinations, some actions are single actor (mono-beneficiary). There will be no dedicated implementation structures and no further support other than the Horizon Europe actions foreseen in the related Horizon Europe programme or cluster.

Strategic planning mechanisms in the Framework Programmes allow for a high level of flexibility in their ability to respond to particular needs over time, building upon additional input in co-creation from stakeholders and programme committees involving MS. The broad scope of the stakeholders providing their input to the research agenda, however, implies a lower level of directionality than what can be achieved through the partnerships. Often, the long-term perspective of the stakeholder input is limited, which risks reducing strategic capacity in addressing priorities.

The Horizon Europe option also implies a lower level of EU budgetary long-term commitment for the priority. Without a formal EU partnership mechanism, it is also less likely that the stakeholders will develop a joint Strategic Research Agenda and commit to its implementation or agree on mutual financial commitments beyond the single project participation.

[7] Proposal for a Regulation of the European Parliament and of the Council stablishing Horizon Europe - the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination - Common understanding', March 2019

1.3.2 European Partnership

All European Partnerships will be designed in line with the new policy approach for more objective-driven and impactful partnerships. They are based on the common criteria in Annex III of the Horizon Europe Regulation, with few distinguishing elements for the different forms of implementation. All European Partnerships will be based on an agreed Strategic Research and Innovation Agenda / roadmap agreed among partners and with the Commission. For each of them the objectives, key performance and impact indicators, and outputs to be delivered, as well as the related commitments for financial and/or in-kind contributions of the partners will be defined ex-ante.

Option 1 - Co-programmed European Partnership

This form of European Partnership is based upon a *Memorandum of Understanding* or a *Contractual Arrangement* signed by the European Commission and the private and/or public partners. Private partners are typically represented by one or more industry association, which also functions as a back-office to the partnership. It allows for a *high flexibility* in the profile of organisation involved, objectives pursued, and/or activities implemented.

Co-programmed European Partnerships address *broader communities* across a diverse set of sectors and/or value chains and where the actors have *widely differing capacities and capabilities*. They may encompass one or more associations of organisations from industry, research, NGOs etc as well as foundations and national R&I funding bodies, with no restriction on the involvement of international partners from Associated and non-associated third countries. Different configurations are possible: private actors only, public entities only, or a combination of the two.

The basis, as for all European Partnerships, is the rationale is to create a *platform for 'concertation'*, i.e. in-depth and ongoing consultation of the relevant actors in the European R&I system for the co-development of a strategic research and Innovation agenda, typically covering the period of the next 10 years. The primary ambition is to generate *commitment to a common strategic research and innovation agenda* (SRIA). For the private actors involved, this would allow for a de-risking of their R&I investments and provide predictability of investment paths, for the public actors, it serves as a means to: inform national policy-makers on EU investments and allows for coordination and alignment of their efforts to support R&I in the field at the national level.

The *level of 'additionality is possibly lower than for other partnerships*. There is no expectation of a legally binding commitment from the partners to taking an integrated approach in their individual R&I implementation and it is based on 'best efforts'. However, the Union contribution to the partnership is defined for the full duration and has a comparable level of certainty for the partnerships than in the other forms of implementation. The priorities for the calls, proposed by the partnership members for integration in the Framework Programme Work Programmes, are subject to further input from Member States (comitology) and Commission Services. The full implementation of the Union contribution in the Framework Programme implies that the full array of Horizon Europe funding instruments in the related Pillar can be used, ranging from RIAs to CSAs and including grants, prizes, and procurement.

Option 2 – Co-funded European Partnership

The Co-funded Partnership is based on a Grant Agreement between the Commission and the consortium of partners, resulting from a call for a proposal for a programme co-fund action implementing the European Partnerships in the Horizon Europe Work Programme. Programme co-fund actions provide co-funding to a programme of activities established and/or implemented by entities managing and/or funding research and innovation programmes. Therefore, this form of implementation only allows to address public partners

at its core (comparable to the Article 185 initiatives below), while industry can nevertheless be addressed by the activities of the partnerships, but not make formal commitments and contributions to it. The expectation is that these entities would cover most if not all EU Member States (MS). Also 'international' funding bodies can participate as partners, which creates the potential for an efficient interaction with strategic international partners. Legal entities in countries that are not part of the programme co-fund consortium, are usually excluded from funding under the calls launched by the consortium.

The basic rationale for this partnership option is to bring MS together to invest at scale in key R&I issues of general and common interest. The joint programme of activities is agreed by the partners and with the EU and typically focuses on societal grand challenges and specifically, areas of high public good where EU action will add value while reflecting national priorities and/or policies. The ultimate intent is to create the greatest possible impact by pooling and/or coordinating national programmes and policies with EU policies and investments, helping to overcome fragmentation of the public research effort. Member States that are partners in this partnership become the 'owners' of the priority and take sole responsibility for its funding. Commitments of the partners and the European Union are ensured through the Grant Agreement.

Based on national programmes, this partnership option shows a particularly high level of flexibility in terms of activities to be implemented - directly by the national funding bodies (or governmental organisation "owning" institutional programmes), or by third parties receiving financial support (following calls for proposals launched by the consortium). The broad range of possible activities include support for networking and coordination, research, innovation, pilot actions, and innovation and market deployment actions, training and mobility actions, awareness raising and communication, dissemination and exploitation, any relevant financial support, such as grants, prizes, procurement, as well as Horizon Europe blended finance or a combination thereof.

Option 3 – Institutionalised European Partnership

This type of Partnership is the most complex and high-effort arrangement and will be based on a Council Regulation (Article 187) or a Decision by the European Parliament and Council (Art 185) and implemented by dedicated structures created for that purpose. The legal base for this type of partnership limits the flexibility for a change in core objectives, partners, and/or commitments as these would require amending legislation.

The basic rationale for this type of partnership is the need for a strong integration of R&I agenda's in the private and/or public sectors in Europe in order to address a strategic challenge or realise an opportunity. The focus is on major long-term strategic challenges and priorities beyond the framework of a single Framework Programme where collective action – by private and/or public sectors – is necessary to *achieve critical mass* and *address the full extent of the complexities* of the ecosystem concerned.

The long-term commitment expected from the European Union and its partners is therefore much larger than for any of the other options, given the considerably higher investment in the preparation and implementation of the Partnership. As a result, this type of partnership can be selected only if other parts of the Horizon Europe programme, including other forms of European Partnerships, would not achieve the objectives or would not generate the necessary expected impacts. The commitment for contributions by the partnership members is expected to be at least equal to 50% and may reach up to 75% of the aggregated European Partnership budgetary commitments.

The partnership members have a high degree of autonomy in developing the strategic research agenda and annual work programmes and call topics, based on a transparent and accessible process, and subject to the approval of the Commission Services. The choice of topics addressed in the (open) calls are therefore strongly aligned with the needs defined. Normally, the strategic priorities are fully covered by the annual work programmes in the

partnership, even though it is in principle possible to keep certain topics for calls in the FP thus complementing the activities in the partnership. The full integration in the Framework Programme implies that the full array of Horizon Europe funding instruments in the related Pillar can be used, ranging from RIAs to CSAs and including grants, prizes, and procurement.

Two forms of Institutionalised Partnerships are of direct relevance to this study, influencing the constellation of partners involved.

Institutionalised Partnerships based upon Art 185 TFEU

Article 185 of the TFEU allows the Union to participate in programmes jointly undertaken by Member States and limits therefore the scope of partners to Member States and Associated Third countries. This type of Institutionalised Partnership aims therefore at reaching the greatest possible impact through the integration of national and EU funding, aligning national strategies in order to optimise the use of public resources and overcome fragmentation of the public research effort.

It brings together R&I governance bodies of most if not all EU Member States (legal requirement: at least 40% of Member States) as well as Associated Third Countries that designate a dedicated legal entity (Dedicated Implementation Structure) for the implementation. By default, membership of non-associated Third Countries is not foreseen. Such membership is possible only if it is foreseen in the basic act and subject to conclusion of an international agreement. Eligibility for participation and funding follows by default the rules of the Framework programme, unless a derogation is introduced in the basic act.

Institutionalised Partnerships under Art. 187 TFEU

This type of Institutionalised Partnership aims at reaching the greatest possible impact by integrating the strategic R&I agendas of private and/or public actors and by leveraging the partners' investments in order to tackle R&I and societal challenges and/or contribute to Europe's wider competitiveness goals.

It brings together a stable set of partners with a strong commitment to taking a more integrated approach and requires the set-up of a dedicated legal entity (Union body, Joint Undertaking) that carries full responsibility for the management of the partnership and implementation of the calls.

Different configurations are possible: partnerships focused on creating strategic industrial partnerships where, most often, the partner organisations are represented by one or more industry associations, or in some cases individual private partners; partnerships coordinating national ministries, public funding agencies, and governmental research organisations in the Member States and Associated Countries; or a combination of the two (the so-called tripartite model). By default, membership of non-associated Third Countries is not foreseen. Such membership is possible only if it is foreseen in the basic act and subject to conclusion of an international agreement. Eligibility for participation and funding follows by default the rules of the Framework programme, unless a derogation is introduced in the basic act.

2 The Candidate European Partnerships under Horizon Europe – What needs to be decided

2.1 Portfolio of candidates for Institutionalised Partnerships under Horizon Europe

2.1.1 The process for identifying the priorities for Institutionalised Partnerships under Horizon Europe

In May 2019, the European Commission consulted the Member States on a list of 44 possible candidates for European Partnership which it had identified as part of the preparation of the first Strategic Planning of Horizon Europe. This list was also part of the

Orientations towards the first Strategic Plan implementing Horizon 2020[8] which served as a basis for an Open Public Consultation from July to October 2019. In October and November 2019, the European Commission and the Member States agreed on increasing the number of candidate European partnerships to 49. Subsequent discussions until the adoption of Horizon Europe will focus on ensuring the overall consistency of the EU partnership landscape and its alignment with the EU overarching priorities and on defining the precise implementation modalities.

In parallel, the European Commission completed inception impact assessments on the candidate institutionalised European partnerships. Stakeholders had the opportunity to provide their feedback on these inception impact assessments in August 2019. A web-based open public consultation to collect opinions on all candidate institutionalised partnerships (but the candidate EuroHPC partnership) was organised between September and October 2019.

2.1.2 Overview of the overall landscape of candidate European Partnerships subject to the impact assessment

Figure 3, below, gives an overview of all European Partnerships that are currently envisaged for funding under Horizon Europe. The candidate Institutionalised Partnerships that are the subject for this impact assessment study are coloured in dark orange.

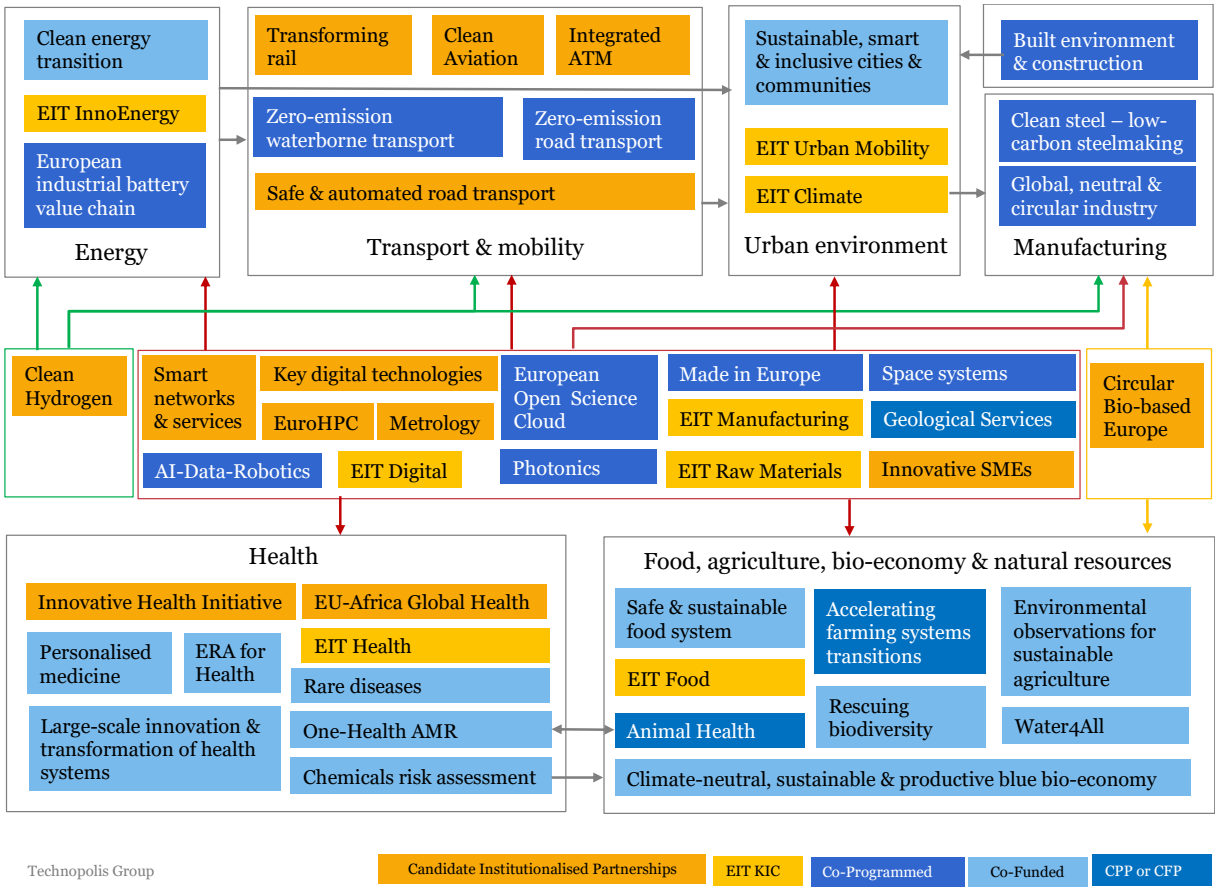
The European Partnerships can be categorised into two major groupings: *'horizontal' partnerships* focused on the development of technologies, methods, infrastructures and resources/materials, and *'vertical' partnerships* focused on the needs and development of a specific application area, be it industrial or societal.

The diagram below shows the central position of the **'horizontal' partnerships** in the overall landscape, developing methodologies, technologies or data management infrastructures for application in the other priority areas. These 'horizontal' partnerships are predominantly proposed as Institutionalised or Co-programmed Partnerships, in addition to a number of EIT KICs. The European Open Science Cloud (EOSC) partnership, for example, will support research partnerships by providing an infrastructure for the storage, management, analysis and re-use of research data.

The upper banner of the diagram groups the **industry-oriented 'vertical' partnerships**. Under Horizon Europe, they have in common a pronounced focus on enhancing sustainability. In this context, the banner includes also one of the most recent agreed-upon partnerships focused on the urban environment. This partnership illustrates the introduction under Horizon Europe of *challenge-oriented* cross-cluster partnerships. Multiple interconnections are envisaged among the 'vertical' partnerships in the different industry sectors covered. In the transport sector, the partnerships are predominantly proposed as Institutionalised Partnerships. In the other sectors, we see a mix of Co-Programmed Partnerships and EIT KICs. There are only two Co-Funded Partnerships.

[8] Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe, Co-design via Web Open Consultation (2019), see more here https://ec.europa.eu/research/pdf/horizon-europe/ec_rtd_orientations-towards-the-strategic-planning.pdf

Figure 3: Landscape of European Partnerships under Horizon Europe (2019)



The lower banner includes the '**vertical' partnerships in the societal application areas**. Striking is the dominance of the Co-Funded Partnerships (to be noted that in the Food/agriculture cluster, the partnership type still needs to be decided for several envisaged partnerships). We also note the limited interconnections that are envisaged between the two areas. An exception is the newly envisaged cross-cluster European Partnerships 'One Health AMR'.

2.2 Assessing the necessity of a European Partnership, possible options for implementation and their cost-effectiveness

In this section we set out the methodological framework that underpins the impact assessment studies. In line with the Better Regulation Guidelines, the impact assessment is intervention logic-based and impact-oriented.

The impact assessment allowed also for the conduct of the 'necessity test' for a European Partnership as set out in the Horizon Europe regulation. Pivotal in this context was the identification of the Horizon Europe calls as Option 0 as well as Baseline Option, allowing for a comparative analysis of the three partnership forms (Options 1-3) along all of the assessment dimensions – in relation to each other as well as to the Horizon Europe calls. The options assessment therefore incorporated the required 'necessity test'.

2.2.1 Assessment of the selection criteria

The common methodological framework that we defined for the 13 individual Impact Assessment studies reflects the approach defined in the Better Regulation guidelines. It also integrates the specific criteria for the use of the different types of European Partnerships as they are defined in the Horizon Europe Common Understanding (Article 8 and Annex III). Specifically this regards the **selection criteria** which have to be demonstrated as a minimum in order to justify the necessity of a European Partnership instead of regular Horizon Europe calls only and the implementation criteria in Article 8

1(a), (b) and (c) with certain elements distinguishing the use of the different partnership implementation modes (Table 1).

Table 1: Horizon Europe selection criteria for the European Partnerships

Common selection criteria and principles	Specifications
More effective (Union added value) clear impacts for the EU and its citizens	• delivering on global challenges and research and innovation objectives
	• securing EU competitiveness
	• securing sustainability
	• contributing to the strengthening of the European Research and Innovation Area
	• where relevant, contributing to international commitments
Coherence and synergies	• within the EU research and innovation landscape
	• coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives or other partnerships and missions
Transparency and openness	• identification of priorities and objectives in terms of expected results and impacts
	• involvement of partners and stakeholders from across the entire value chain, from different sectors, backgrounds and disciplines, including international ones when relevant and not interfering with European competitiveness
	• clear modalities for promoting participation of SMEs and for disseminating and exploiting results, notably by SMEs, including through intermediary organisations
Additionality and directionality	• common strategic vision of the purpose of the European Partnership
	• approaches to ensure flexibility of implementation and to adjust to changing policy, societal and/or market needs, or scientific advances, to increase policy coherence between regional, national and EU level
	• demonstration of expected qualitative and significant quantitative leverage effects, including a method for the measurement of key performance indicators
	• exit-strategy and measures for phasing-out from the Programme
Long-term commitment of all the involved parties	• a minimum share of public and/or private investments
	• In the case of institutionalised European Partnerships, established in accordance with article 185 or 187 TFEU, the financial and/or in-kind, contributions from partners other than the Union, will at least be equal to 50% and may reach up to 75% of the aggregated European Partnership budgetary commitments

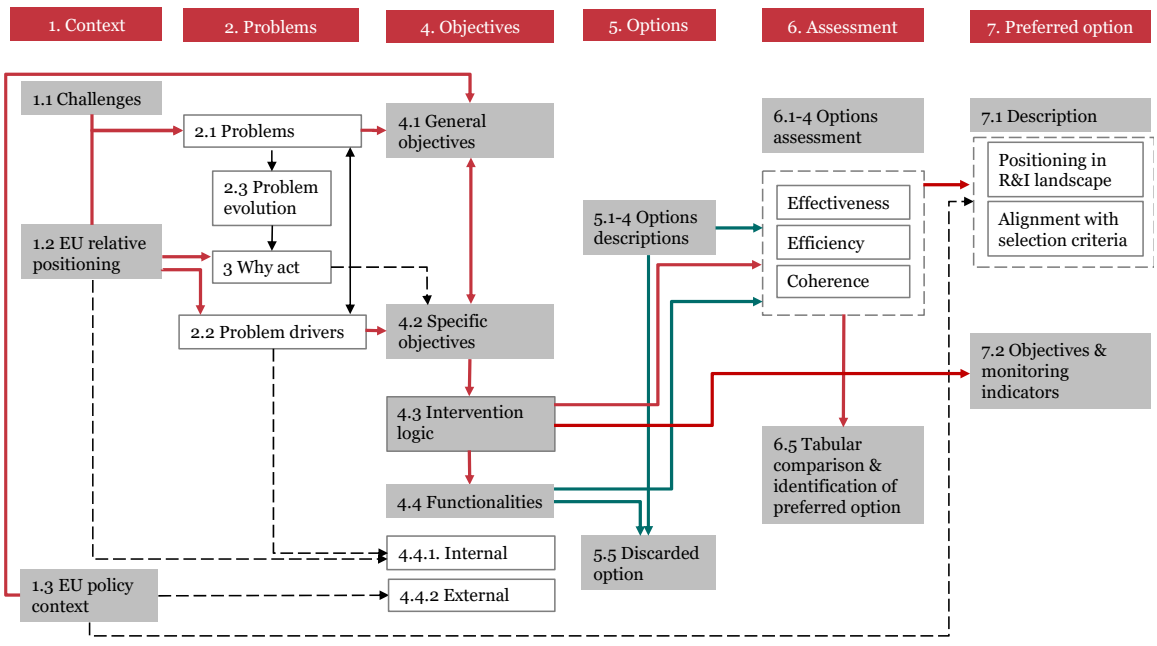
The **Better Regulation guidelines** remained the primary point of reference for the 13 individual Impact Assessment studies. The different steps of the IA process were carried out in a consistent manner in the 13 individual IA studies, supported by horizontal analyses (i.e. common to all studies) such as bibliometrics/patent analysis, social network analysis, the partnership portfolio mapping and analysis, as well as the analysis of the Open Public Consultation data.

The **selection criteria** for the European Partnerships related to effectiveness and coherence fit reasonably well in the Better Regulation impact assessment structure. More problematic was the coverage of the other three criteria groupings, i.e. the criteria of Openness and Transparency, Additionality and Directionality, and the Ex-ante demonstration of commitment.

The solution was the introduction of a section on the **'Functionalities of the initiative'**, in which set out our view on *how* the initiative should *concretely* respond to the selection criteria of 'coherence and synergies', 'openness and transparency' and 'additionality and directionality' in order to reach its objectives. We focused on those aspects that are not covered in other sections of this report, such as coherence and synergies, and covered those elements that from our analysis of the partnership options resulted being **key distinguishing features** of the partnership options, i.e. the composition of the partnership ('openness', including from a geographical perspective), the type of activities implemented ('flexibility'), and the level of directionality and integration of the stakeholders' R&I strategies needed ('directionality and additionality').

The logical process is summarised in Figure 4, below. The diagram shows how the 'functionality' sections constituted an important passage from the objectives and intervention logic sections to the options assessment. Building upon information collected in the previous sections (context, problem and objectives analysis) and in combination with the description of the available options, the description of the desirable 'functionalities' allowed for, on the one hand, the identification of the discarded option(s) and, on the other hand, the options assessment against coherence and against the selection criteria of 'Openness and Transparency' and 'Additionality and Directionality'. In the final chapter of the Impact Assessment report, the alignment of the preferred option with the criteria for the selection of European Partnerships was described, emphasising the outcomes of the 'necessity test'.

Figure 4: Flow of the analysis



Notes: the numbers indicate the related chapters or sections in the Impact Assessment reports

2.2.2 Methodological approach

Overview of the methodologies employed

The understanding of the overall context of the candidate institutionalised European Partnerships relies on a desk research partly covering the main impacts and lessons learned

from their predecessor partnerships (if any). This was complemented with a set of quantitative analyses of the Horizon 2020-funded partnerships, or in case these did not exist, the H2020-funded projects in the field. The analyses included a portfolio analysis, a stakeholder and social network analysis in order to profile the actors involved as well as their co-operation patterns, and an assessment of the partnerships' outputs (bibliometrics and patent analysis). A cost modelling exercise was performed in order to feed into the efficiency assessments of the partnership options (see below).

Public consultations (open and targeted) supported the comparative assessment of the policy options. Each study interviewed up to 50 relevant stakeholders (policymakers, business including SMEs and business associations, research institutes and universities, and civil organisations, among others). They also used the results from the Open Public Consultation organised by the European Commission (Sep – Nov 2019) and the feedback on the Inception Impact Assessments of the 13 candidate institutionalised European Partnerships that the European Commission received in September 2019.

The timing of the Impact Assessment studies, in parallel to the negotiations between the European Commission and the existing Joint Undertakings on the specific implementation of the rules for the future European Partnership, as well as the ongoing discussions within the existing partnership on their future research directions, has set potential limits to the validity of the input and feedback collected from the stakeholders during the consultations.

A more detailed description of the methodology is provided in the Annexes C of each impact assessment report.

Method for identifying the preferred choice

The four policy options were compared along a range of key parameters. The comparison along these parameters was carried out in an evidence-based manner. A range of quantitative and qualitative evidence was used, including ex-post evaluations; foresight studies; statistical analyses of Framework Programmes application and participation data and Community Innovation Survey data; analyses of science, technology and innovation indicators; econometric modelling exercises producing quantitative evidence in the form of monetised impacts; reviews of academic literature on market and systemic failures and the impact of research and innovation, and of public funding for research and innovation; sectoral competitiveness studies; expert hearings; etc.

Options assessment related to effectiveness and coherence

On the basis of the evidence collected and gathered, the Impact Assessment study teams assessed the effectiveness of the retained policy options along three dimensions corresponding to the different categories of likely impacts: scientific, economic and technologies, and societal (including environmental) impacts. The Impact Assessment study teams considered to which extent the retained policy options fulfilled the desirable 'functionalities' and were therefore likely to produce the targeted impacts. This analysis resulted in a scoring of the policy options along a three-point scale.[9] Instead of a compound score, the assessment of the effectiveness of the policy options concluded on as many scores as there are expected impacts.

Likewise, the impact assessment study teams attributed scores (using the same approach as above) reflecting the potential of each retained policy option for ensuring coherence with programmes and initiatives within (internal coherence) and beyond (external coherence) Horizon Europe.

[9] Scores vary from + to +++, where + refers to low potential for presenting a low potential for reaching the likely impacts, ++ to a good potential, and +++ to a high potential.

Scores were justified in a consistent and detailed manner in order to avoid arbitrariness and spurious accuracy. A qualitative or even quantitative explanation was provided of why certain scores were given to specific impacts.

When assessing the respective efficiency of the retained policy options, the Impact Assessment study teams considered the scores related to effectiveness and the identified costs to conduct a "value for money" (or cost-effectiveness) analysis. They accordingly attributed a comparative score to each of the options ranging from 1 (option with the highest costs) to 3 (options with the lowest costs).

Options assessment related to efficiency

A standard cost model

The 'horizontal' team has reviewed the cost categories and costs for each of the four policy options, at some length. Our first model used published data from past partnerships and Horizon 2020 calls working with the Commission's standard accounting codes (Title 1, Title 2, Title 3). The analysis revealed wide-ranging differences in costs across partnerships and functions, which was thought to be too complex to be helpful to the current exercise. As a result, we created a static, common model using average costs as a means by which to indicate the order of magnitude of effort and thereby reveal the principal differences between each of the policy options.

The model was developed jointly with the European Commission services and is presented in the study Data report (D1.2), along with an explanation of the data sources used and the assumptions made.

It is important to note that the costs identified are theoretical and do not reflect the actual costs of any existing individual partnership. In light of this fact, and to avoid any risk of misunderstanding, we have transposed the financial estimates into a qualitative presentation using + / - system in order to compare the various cost elements for each policy option with the equivalent costs for the baseline policy options (see Table 2).

The principal differences in costs as compared with regular Horizon Europe calls relate to the European Partnerships' one-off costs (e.g. developing the proposal and Strategic Research and Innovation Agenda), additional supervision by the European Commission and any additional programme management effort. The main difference between the three types of European Partnership are twofold: (i) the extent to which a partnership will need to run a limited or comprehensive programme management unit and (ii) the extent to which a new partnership may benefit from a pre-existing programme management unit that will greatly reduce or eliminate the set-up costs that would apply to a wholly new partnership.

Table 2: Intensity of additional costs compared with HEU Calls (for Partners, stakeholders, public and EC)

Cost items	Option 0	Option 1	Option 2	Option 3 -Art. 185	Option 3 -Art. 187
Preparation and set-up costs					
Preparation of a partnership proposal (partners and EC)	0	++	++	++	++
Set-up of a dedicated implementation structure	0	0	0	Existing: + New: ++	Existing: ++ New: +++
Preparation of the SRIA / roadmap	0	++	++	++	++

Cost items	Option 0	Option 1	Option 2	Option 3 -Art. 185	Option 3 -Art. 187
Ex-ante Impact Assessment for partnership	0	0	0	+++	+++
Preparation of EC proposal and negotiation	0	0	0	+++	+++
Running costs (Annual cycle of implementation)					
Annual Work Programme preparation	0	+	0	+	+
Call and project implementation	0	0 In case of MS contributions: +	+	+	+
Cost to applicants	Comparable, unless there are strong arguments of major differences in oversubscription				
Partners costs not covered by the above	0	+	0	+	+
Additional EC costs (e.g. supervision)	0	+	+	+	++
Winding down costs					
EC	0	0	0	0	+++
Partners	0	+	0	+	+

Notes: 0: no additional costs, as compared with the baseline; +: minor additional costs, as compared with the baseline; ++: medium additional costs, as compared with the baseline; +++: higher costs, as compared with the baseline

Rationale for the comparative scoring on 'overall costs' and 'cost-efficiency' in the scorecard

In the scorecard analysis, the scores related to the set-up and implementation costs will allow the study teams to consider the scale of the expected benefits and thereby allow a simple "value for money" analysis (cost-effectiveness).

Table 3 shows how we translated the cost analysis into a series of numerical scores.

Table 3: Cost-efficiency matrix

	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 2: Co-funded	Option 3: Institutionalised
Overall cost	3	2	1	1
Cost-efficiency	3	3	2	2

For the 'overall cost' dimension, we assigned a score 1 to the option with the highest additional costs and a score 3 to the option with the lowest additional costs compared to the baseline. This was based on the following considerations:

- **Horizon Europe regular calls** will have the lowest overall cost among the policy options and have therefore been **scored 3** on this criterion, using a scale of 1-3 where 3 is best (lowest additional costs). This adjudged score is based on two facts: firstly, that Horizon Europe will not entail any additional one-off costs to set up or discontinue

the programme, where each of the other policy options will require at least some additional set-up costs; and secondly, that Horizon Europe will not require any additional running costs, where each of the other policy options will involve additional efforts by the Commission and partners in the carrying out of necessary additional tasks (e.g. preparing annual work programmes).

- A **co-programmed partnership** (Option 1 - CPP) will entail slightly higher overall costs as compared with the baseline policy option and has therefore been given a **score of 2**, using a scale of 1-3 where 3 is best (lowest additional costs). There will be some additional set-up costs linked for example with the creation of a strategic research and innovation agenda (SRIA) and additional running costs linked with the partners role in the creation of the annual work programmes and the Commission's additional supervisory responsibilities. A CPP will have lower overall costs than each of the other types of European Partnership, as it will function with a smaller governance and implementation structure than will be required for a Co-Funded Partnership or an Institutionalised Partnership and – related to this – its calls will be operated through the existing HEU agencies and RDI infrastructure and systems.
- The **Co-Funded Partnership (**Option 2 – CFP) has been **scored 1** on overall cost, using a scale of 1-3 where 3 is best (lowest additional costs). This reflects the additional set-up costs of this policy option and the substantial additional running costs for partners, and the Commission, of the distributed, multi-agency implementation model.
- The **Institutionalised Partnership** (Option 3 - IP) has been **scored 1** on overall cost, using a scale of 1-3 where 3 is best (lowest additional costs). This reflects the substantial additional set-up costs of this policy option – and in particular the high costs associated with preparing the Commission proposal and negotiating that through to a legal document – and the substantial additional running costs for the Commission associated with the supervision of this dedicated implementation model.

In relation to **cost-efficiency**, we considered that while there is a clear gradation in the overall costs of the policy options, the cost differentials are less marked when we take into account financial leverage (co-financing rates) and the total budget available for each of the policy options, assuming a common Union contribution. From this perspective, there are only one or two percentage points that split the most cost-efficient policy options – the baseline and CPP policy options – and the least cost-efficient – the CFP and IP. We have therefore assigned a score of 3 to the baseline Option 0 and CPP options for cost-efficiency (no or minor additional costs, as compared with the baseline) and a score of 2 for the CFP and IP policy options (medium additional costs, as compared with the baseline).

Scorecard analysis for the final options assessment

The scorecard analysis built a hierarchy of the options by individual criterion and overall. The scorecard exercise supported the systematic appraisal of alternative policy options across multiple types of monetary, non-monetary and qualitative dimensions. It also allowed for easy visualisation of the pros and cons of alternative options.

Each option was attributed a value of 1 to 3, scoring the adjudged performance against each criterion with the three broad appraisal dimensions of effectiveness, efficiency and coherence.

Scores were justified in a consistent and detailed manner in order to avoid arbitrariness and spurious accuracy. A qualitative or even quantitative explanation was provided of why certain scores were given to specific impacts, and why one option scores better or worse than others.

The scorecard analysis allowed for the identification of a single preferred policy option or in case of an inconclusive comparison of options, a number of 'retained' options or hybrid. The final selection is a policy decision.

2.3 Cross-partnership challenges in Horizon Europe clusters

In this section we set the envisaged and candidate partnerships in the context of the Horizon Europe clusters and the related higher-level EU policy objectives and priorities. We focus on the evolution of the policy context including the new European Green Deal/climate neutrality objectives, the Horizon Europe Framework relevant to this cluster, and the link to the relevant Sustainable Development Goals. Seeing the focus on the Pillar II clusters, this section excludes the candidate *Institutionalised Partnership for Innovative SMEs*.

2.3.1 Cluster 1 – Health

Research and innovation (R&I) actions under this cluster will aim at addressing the major socio-economic and societal burden that diseases and disabilities pose on citizens and health systems of the EU and worldwide.

The R&I activities funded under the Pillar II Cluster Health aim at contributing to the achievement of the Sustainable Development Goal 'Ensuring healthy lives and promoting well-being for all at all ages' resulting from investments in research and innovation focused on three overarching EU policy objectives: 'An economy that works for people', 'A Europe fit for the Digital Age', and 'A European Green Deal' (see Figure 5, below). The Horizon Europe proposal for a regulation defined the areas for possible institutionalised European partnerships on the basis of Article 185 TFEU or Article 187 TFEU as "*Partnership Area 1: Faster development and safer use of health innovations for European patients, and global health".*

At the core in this cluster are the R&I orientations that aim at ensuring that citizens *stay healthier throughout their lives* due to improved health promotion and disease prevention and the adoption of healthier behaviours and lifestyles, the development of *effective health services* to tackle diseases and reduce their burden, and an improved access to *innovative, sustainable and high-quality health care*. These objectives require an unlocking of the full potential of *new tools, technologies and digital solutions* and ensuring a *sustainable and globally competitive health-related industry* in the EU, allowing for the delivery of, e.g. personalised healthcare services. Last but not least, the citizens' health and well-being need to be *protected from environmental degradation and pollution*, addressing a.o. climate-related challenges to human health and health systems.

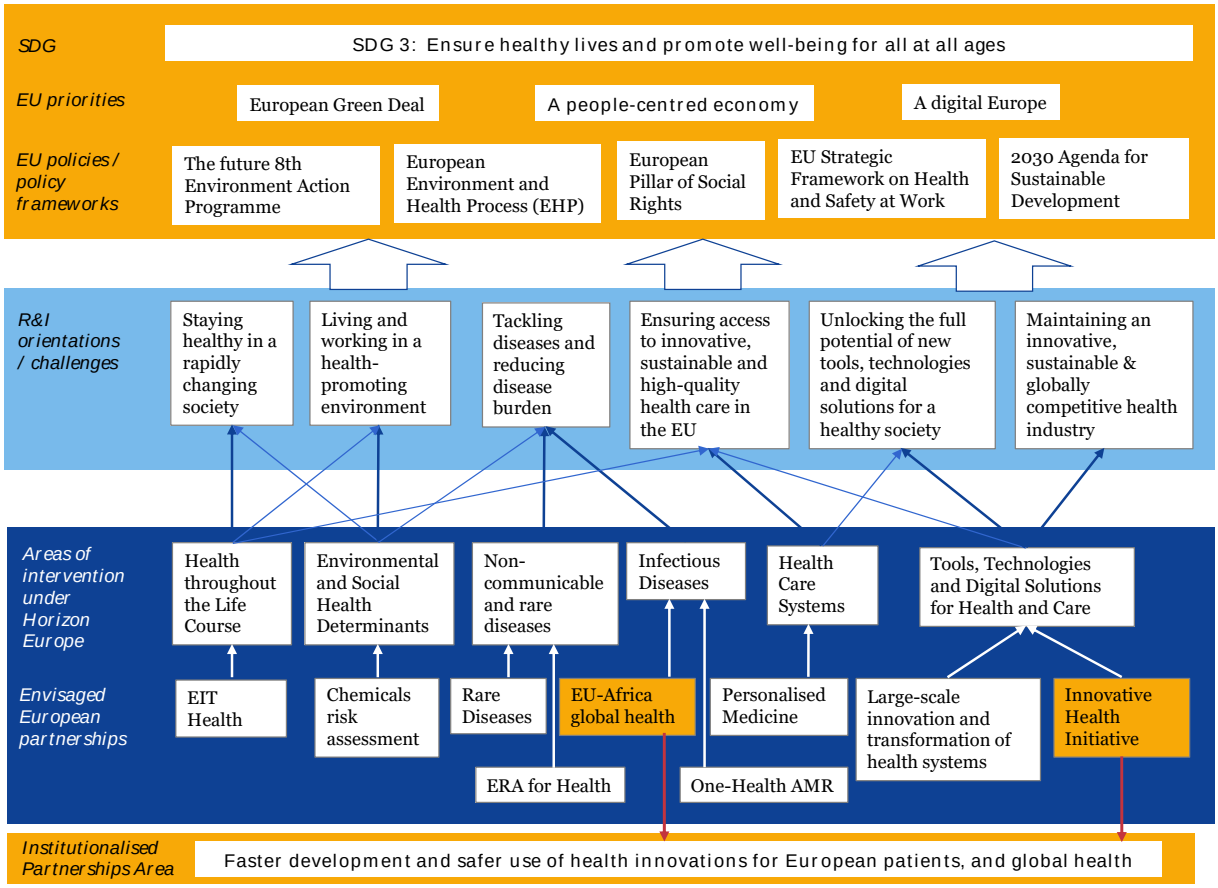
Figure 5, below, shows that the portfolio of envisaged European Partnerships in this cluster[10] aims to contribute to all of the R&I orientations in this cluster. However, there is a pronounced focus on the 'tackling diseases and reducing the disease burden' objective, addressed by five out of the ten partnerships (amongst which there is one candidate Institutionalised Partnership). The objectives focused on an improved exploitation of digital solutions and competitiveness of the EU health-related industry are addressed by two partnerships amongst which one is a candidate Institutionalised Partnership.

In this context, it should be noted that the portfolio of European Partnerships in this cluster predominantly encompasses Co-funded Partnerships, focused on joining the R&I programmes and investments at the national level. There is therefore overall a limited level of involvement of the private sector in the development of the SRIAs (i.e. as partners of the envisaged partnerships), be it from the supply or user side in the value chains. The only exceptions are the Innovative Health Initiative and the EIT KIC Health. European Partnerships also provide limited support for the assessment of environmental and social health determinants, uniquely addressed from a chemical risks perspective.

[10] As proposed in the Horizon Europe 'Orientations towards the first Strategic Plans', dd. December 2019

The description of the interconnections between the partnerships in this cluster and the ones funded in the context of other clusters, provided in the reports of the individual impact assessment studies, sheds more light on this topic.

Figure 5: R&I priorities and higher-level objectives of the Horizon Europe Cluster 1 – Health



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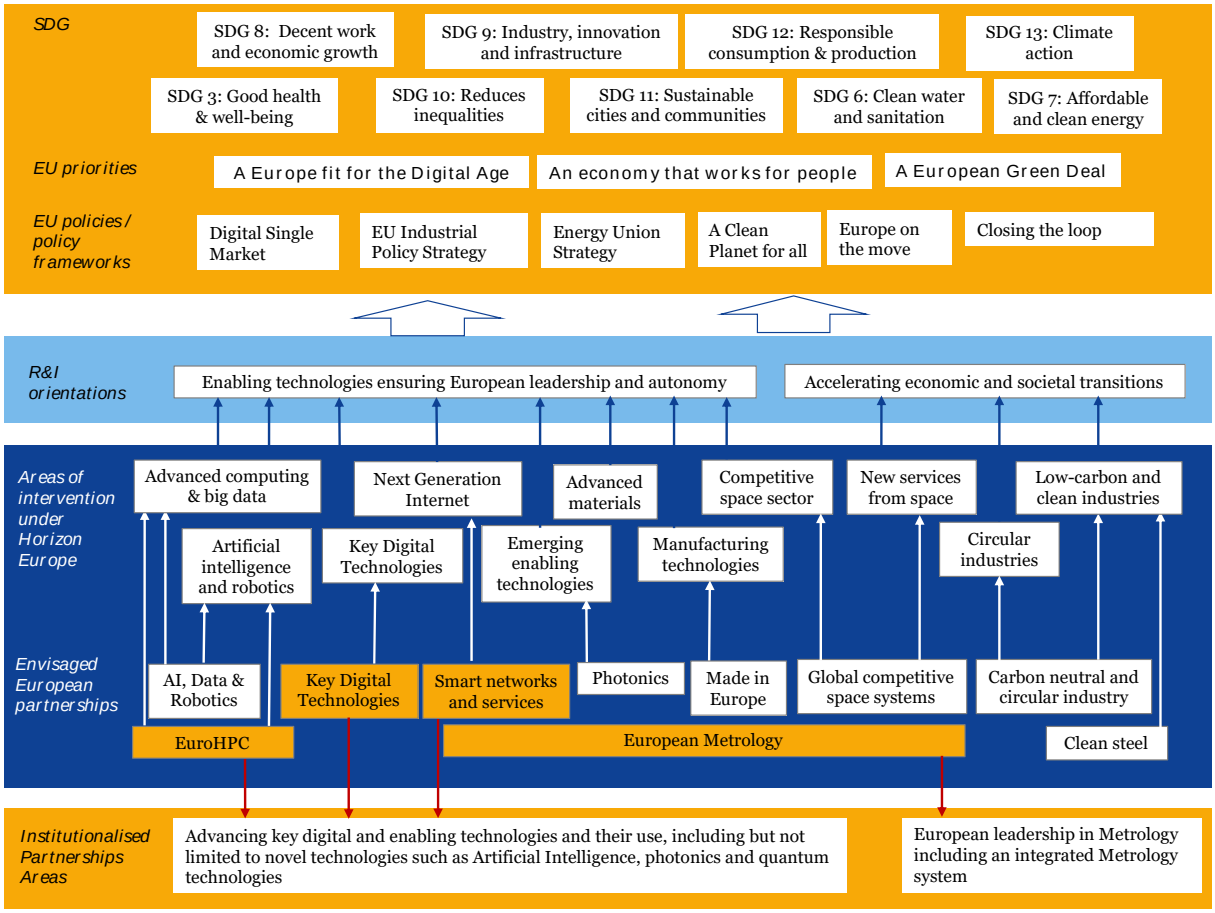
2.3.1 Cluster 4 – Digital, Industry and Space

In this cluster the focus is on the digitisation of European industry and on advancing key enabling, digital and space technologies which will underpin the transformation of our economy and society at large. The overarching vision for R&I investments in this cluster is "a European industry with global leadership in key areas, fully respecting planetary boundaries, and resonant with societal needs – in line with the renewed EU Industrial Policy Strategy." The expected effects on the European economy and society imply that the R&I activities under this cluster will contribute to various Sustainable Development Goals and respond to three key EU policy priorities: 'A European Green deal', 'A Europe fit for the digital age', and 'An economy that works for people' (Figure 6).

The cluster pursues three objectives: 1) ensuring the competitive edge and sovereignty of EU industry; 2) fostering climate-neutral, circular and clean industry respecting planetary boundaries; and 3) fostering social inclusiveness in the form of high-quality jobs and societal engagement in the use of technologies. A human-centred approach will be taken, i.e. technology development going hand in hand with European social and ethical values.

The key R&I priorities are grouped in two general categories: (I) Enabling technologies ensuring European leadership and autonomy; and (II) Accelerating economic and societal transitions (these will be complemented by priorities of other clusters). European Partnerships envisaged to support the R&I in the specific intervention areas are mainly co-programmed partnerships. Exceptions are the three candidate Institutionalised Partnerships in the digital field and the candidate Institutionalised Partnership in metrology, reflecting their related Partnership Areas.

Figure 6: R&I priorities and higher-level objectives of the Horizon Europe Cluster 4 – Digital, Industry and Space



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Multiple convergences exist between the technologies that are covered in the first strand of the priorities in this cluster, i.e. "enabling technologies ensuring European leadership and autonomy". In their function of 'enabling' technologies, they will also make critical contributions to the attainment of the desired 'transitions' in the 'vertical' industry sectors targeted in the second strand of priorities in this cluster as well as in the other clusters. A major contribution from this perspective can be expected from the four candidate Institutionalised Partnerships as well as from the 'Made in Europe' partnership, focused on manufacturing technologies.

2.3.2 Cluster 5 – Climate, Energy and Mobility

The main objectives of this cluster are to fight climate change, improve the competitiveness of the energy and transport industry as well as the quality of the services that these sectors bring to society. This is supportive of several Sustainable Development Goals including affordable and clean energy (SDG7); industry, innovation & infrastructure (SDG9); sustainable cities & communities (SDG11); sustainable consumption & production (SDG12); and climate action (SDG13). The cluster is most closely aligned to the EU priority for 'A European Green Deal' but also has synergy with two of the other five priorities; 'An economy that works for people' and 'A Europe fit for the Digital Age'. This extends across various policies including a Clean Planet for all, the Energy Union strategy, Single European Railway Area, European ATM Master Plan, Single European Sky, and Europe on the Move (Figure 7).

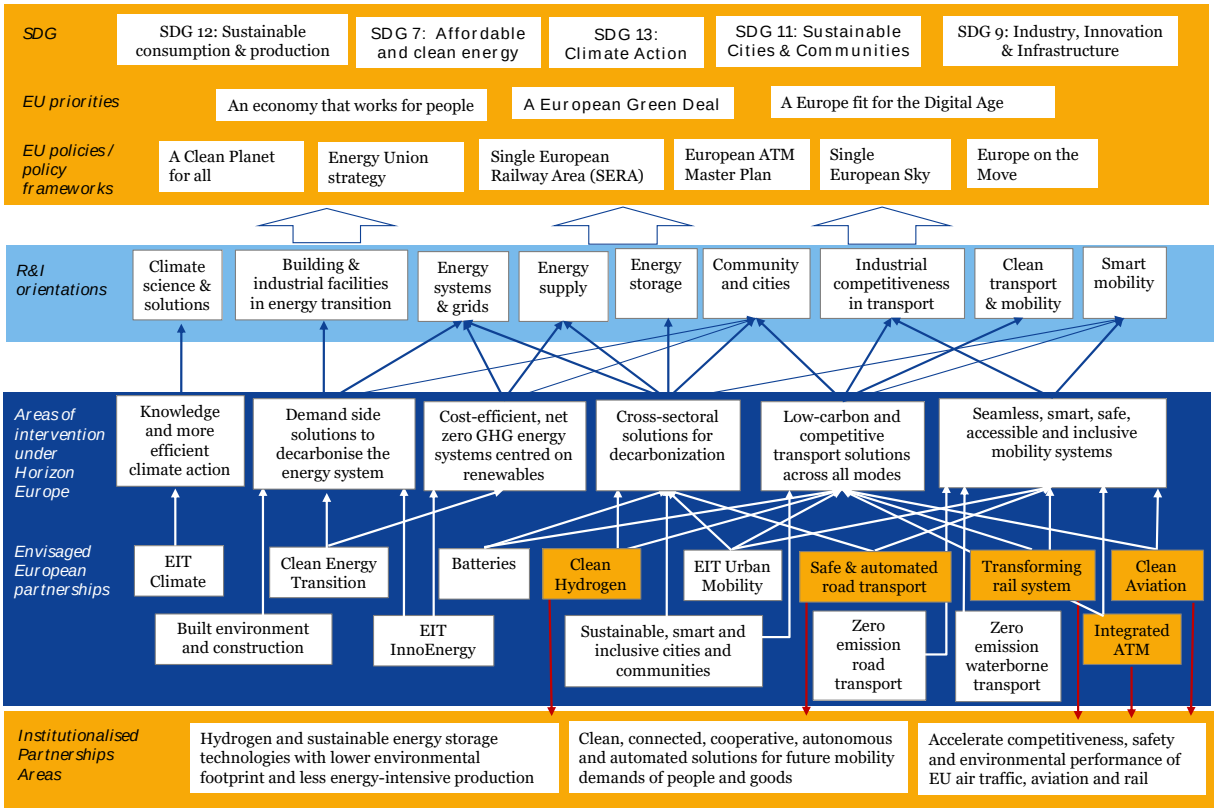
The cluster is directly relevant to several of the areas for possible institutionalised European partnerships on the basis of Article 185 TFEU or Article 187 TFEU, namely:

- Partnership Area 4: Accelerate competitiveness, safety and environmental performance of EU air traffic, aviation and rail

- Partnership Area 6: Hydrogen and sustainable energy storage technologies with lower environmental footprint and less energy-intensive production
- Partnership Area 7: Clean, connected, cooperative, autonomous and automated solutions for future mobility demands of people and goods

Cluster 5 is structured under six areas of intervention under Horizon Europe and nine R&I orientations. Figure 7, below, shows the portfolio of envisaged European Partnerships that are relevant to this cluster and their link to the areas of intervention.

Figure 7: R&I priorities and higher-level objectives of the Horizon Europe cluster Climate, Energy and Mobility



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There are 14 candidate Partnerships that align with this cluster of which eight are possible Institutionalised Partnerships, including five Article 187 initiatives and three EIT-KICs. There are no candidate Article 185 Partnerships in this cluster. The other partnerships are envisaged as either Co-programmed and/or Co-funded Partnerships.

The diagram above shows the strong orientation of the possible Institutional Partnerships towards the mobility area and more limited direct synergies between the envisaged Partnerships and the 'climate science & solutions' priority. Of course, the climate change challenge underpins the whole of this cluster, except where the focus is on industrial competitiveness, but this will also be at least partially dependent on innovation related to clean energy and mobility products and services.

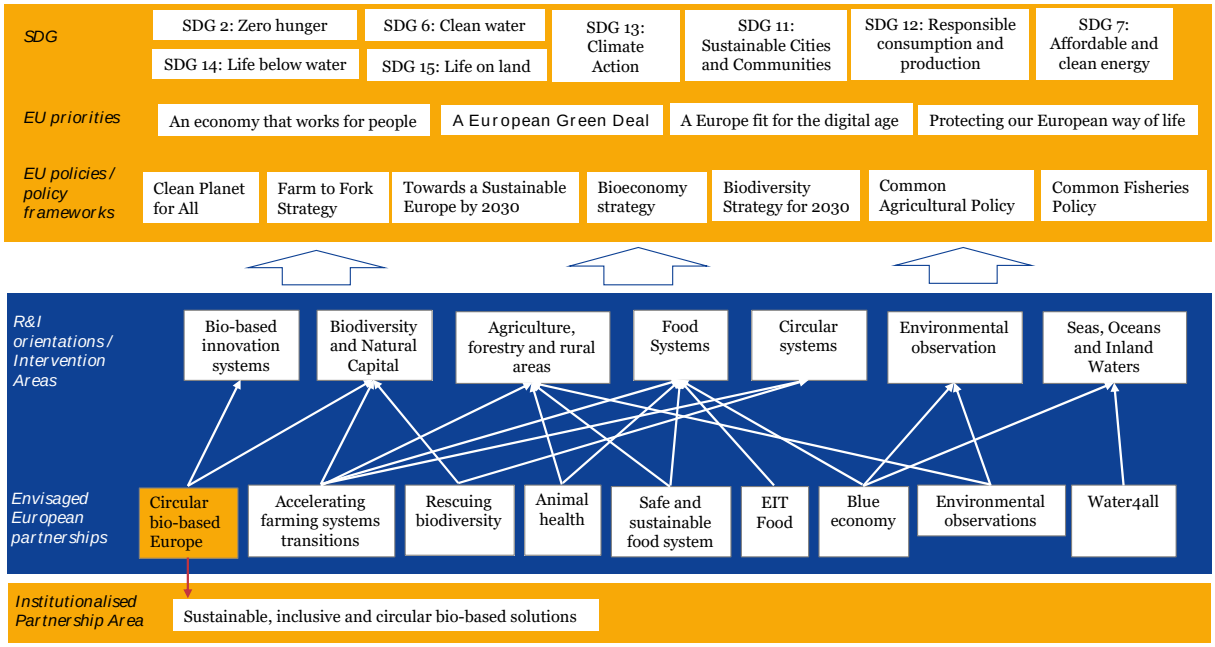
2.3.3 Cluster 6 – Food, Bioeconomy, Natural Resources, Agriculture and Environment

The key objective of Cluster 6, 'Food, Bioeconomy, Natural Resources, Agriculture and Environment' is to advance knowledge, expand capacities and deliver innovative solutions to accelerate the transition towards the sustainable management of natural resources (such as biodiversity, water and soils). The cluster has a large realm and aims to address a wide range of challenges relating to climate change, biodiversity and ecosystems, natural resources, and the production and consumption patterns that may affect them. It encompasses a single area for possible institutionalised European Partnerships aimed at the development of "sustainable, inclusive and circular, bio-based solutions".

The R&I activities funded under the Pillar II Cluster 6 contribute first and foremost to the 'European Green Deal'. More precisely, they will be instrumental to the announced climate change actions, the Biodiversity Strategy for 2030, the "Farm to Fork Strategy", the zero-pollution ambition, the New Circular Economy Action Plan, and the comprehensive strategy on Africa and trade agreements. However, through cooperation with the other clusters, Cluster 6 may make some contribution to the other EU overarching policy priorities. The R&I activities funded under this cluster therefore aim to contribute to the achievement of several United Nations SDGs including: SDG 2: Zero hunger; SDG 6: Clean water and sanitation; SDG 7: Affordable and clean energy; SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production; SDG 13: Climate action; SDF 14: Life below water; and, SDG 15: Life on land.

Cluster 6 is structured around six targeted impacts and seven research and innovation orientations, as shown in Figure 8, below. The R&I activities funded under this cluster aim to (1) develop solutions for mitigation of, and adaptation to, *climate change*; (2) halt the *biodiversity* loss and foster the restoration of *ecosystems*; (3) encourage the sustainable (and circular) management and use of *natural resources*; (4) stimulate inclusive, safe and health *food and bio-based systems*; (5) a better understanding of the determinants of *behavioural, socio-economic and demographic changes* to accelerate system transformation; and, (6) improve solutions for *environmental observations and monitoring systems*.

Figure 8: R&I priorities and higher-level objectives of the Horizon Europe Cluster 6 – Food, Bioeconomy, Natural Resources, Agriculture and Environment



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The European Commission envisages nine partnerships under Cluster 6, two of which would be institutionalised (Circular bio-based Europe and EIT Food), four would be either co-programmed or co-funded (Animal Health; A climate-neutral, sustainable and productive Blue Economy; Safe and Sustainable Food Systems for People, Planet and Climate; Water4All), and three would be co-funded (Accelerating Farming System Transition; Agriculture for Data; Rescuing Biodiversity to safeguard life on Earth).

There is seemingly a good balance between the three types of partnerships. However, industry may have some interest in being involved in the design of the Strategic Research and Innovation Agendas regarding living labs and other research infrastructure ('Towards more sustainable Farming' envisaged partnership) to develop solutions for accelerating the transition of farming systems, and technologies to collect agriculture data.

The proposed portfolio of European Partnerships covers the full range of R&I orientations under Cluster 6.

All but one of the proposed partnerships contribute to orienting R&I activities towards the development of food systems that will ensure both sustainable and healthy diets and food and nutrition security for all. The food system has an impact on several challenges. It directly relates to nutrition and diets, access to food, food security, and has an influence on the use of natural resources, water and soil pollution, climate change. Food waste is a key component of circular systems and biomass has strong potential to offer bio-based energy solutions. Finally, the transformation of food systems should take into consideration demographic changes and the accelerating urbanisation (which reduces lands available for food production but offers opportunities for new types of agriculture such as urban farming).

Two R&I orientations are covered by less than half of the proposed partnerships: Environmental Observations (even though achievement in this area could make significant contribution to the other areas) and Bio-based innovation systems (which is nevertheless at the core of the candidate institutionalised partnership for a circular bio-based Europe).

EUROPEAN COMMISSION

Part I. Impact Assessment Studies for the Candidate Institutionalised European Partnerships

12. Candidate Institutionalised European Partnership on Safe and Automated Road Transport

Authors

George Lunt, Meghan Evans, Catherine Swift, John Davis

2020 Directorate-General for Research and Innovation EN

Abstract

This document is the final report of the Impact Assessment Study for the candidate Institutionalised European Partnership Safe and Automated Road Transport under Horizon Europe. The study was conducted by AECOM from July to December 2019, under coordination of Technopolis Group. The methodological framework reflects the Better Regulation Guidelines and operationalises the selection criteria for European Partnerships set out in the Horizon Europe Regulation.

This initiative focuses on Connected, Cooperative and Automated Mobility: the use of connected and automated vehicles to create more user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation. With current road traffic collisions and negative local and global environmental impacts not reducing quickly enough, it will address the challenges raised by the current fragmentation of research across the field, and the threat to European competitiveness if the research agenda does not advance quickly enough.

The initiative will focus on strengthening EU scientific capacity and economic competitiveness in the field of CCAM, whilst contributing to wider societal benefits including improved road safety, less environmental impact, and improved accessibility to mobility.

The study concluded that a co-programmed partnership is the preferred option for the implementation of this initiative.

Executive Summary

This document is the final report of the Impact Assessment Study for the candidate Institutionalised European Partnership Safe and Automated Road Transport under Horizon Europe. The study was conducted by AECOM from July to December 2019, under coordination of Technopolis Group. The methodological framework for this study (described in Part 1 of this report) reflects the Better Regulation Guidelines and operationalises the selection criteria for European Partnerships set out in the Horizon Europe Regulation. Part 1 also sets out the political and legal context that is common to all candidate partnerships. Part 2 contains the findings of this specific study.

This initiative focuses on Connected, Cooperative and Automated Mobility: the use of connected and automated vehicles to create more user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation. This requires a system approach to innovation, rather than developing automated vehicles by themselves. The focus is on road transport although it includes interfaces with other modes. This initiative will build on the existing CCAM platform which looks to better coordinate development, pre-deployment, testing and implementation.

Current road traffic collisions and negative environmental impacts are not reducing quickly enough to address policy objectives. CCAM solutions can help deliver on these objectives but the technical solutions and integration frameworks are insufficiently advanced to have a significant positive impact. Advancing the solutions is difficult due to the complexity and far reaching research still required, and the diverse value chain (including private, public, academic and stakeholder groups) required to deliver it is currently fragmented. Without significant progress in the field EU competitiveness in scientific and industrial sectors will be reduced.

The Safe and Automated Road Transport initiative will focus on strengthening EU scientific capacity and economic competitiveness, whilst contributing to wider societal benefits including road safety and environmental impact. The initiative will bring together key actors across private industry, research bodies public authorities and representative groups. Delivery will be focussed around technological development, service design demonstration & impacts, and coordination & integration. Collaboration and leverage outside of the core programme will be important, including alignment with other partnerships, integration with deployment programmes and Member State strategies, and supporting emerging regulations and standards.

The relevant policy options for this assessment were Horizon Europe calls only, a co-programmed partnership, or an institutionalised partnership. **Our conclusion is that a co-programmed partnership is the preferred option.** The co-programmed partnership will provide significant improvements on directionality over the baseline, whilst allowing flexibility of approach over time which the institutionalised partnership cannot guarantee.

However, there are benefits the institutionalised partnership could have in the future, and it is recommended it should be regularly reviewed whilst the partnership is maturing. At a time when the societal impacts are better understood, and greater alignment of objectives across the value chain is achieved, then the co-programmed partnership could be stable enough for a more significant joint undertaking.

Résumé exécutif

Ce document est le rapport final de l'étude de support à l'analyse d'impact de la proposition de partenariat européen institutionnalisé pour un transport routier sûr et automatisé dans le cadre d'Horizon Europe. Cette étude a été menée par AECOM et coordonnée par Technopolis entre juillet et décembre 2019. Le cadre méthodologique de cette étude (décrit dans la première partie de ce rapport) tient compte des lignes directrices pour une meilleure réglementation et opérationnalise les critères de sélection des partenariats européens définis dans le règlement d'Horizon Europe. La première partie présente également le contexte politique et juridique commun à tous les partenariats proposés. La deuxième partie contient les résultats spécifiques à cette étude.

Cette initiative concerne la mobilité connectée, coopérative et automatisée, c'est-à-dire l'utilisation de véhicules connectés et automatisés pour créer une mobilité globale, axée sur l'utilisateur, tout en améliorant par la même occasion la sécurité, en réduisant les embouteillages et en contribuant à la décarbonisation. Cette initiative nécessite une approche systémique de l'innovation, plutôt que la conception de véhicules automatisés en tant que telle. L'accent est mis sur le transport routier, même des interfaces avec d'autres moyens de transport sont prévues. Cette initiative tirera parti de la plate-forme MCCA existante visant à mieux coordonner le développement, le pré-déploiement, les tests et la mise en œuvre.

Les accidents de la circulation routière et les impacts environnementaux négatifs actuels ne diminuent pas assez vite pour atteindre les objectifs stratégiques. Les solutions de mobilité coopérative, connectée et automatisée (MCCA) peuvent certes contribuer à ces objectifs, mais les solutions techniques et les cadres d'intégration ne sont pas suffisamment poussés pour avoir un impact positif significatif. Or, il n'est pas évident de faire progresser ces solutions en raison de leur complexité et des recherches poussées encore nécessaires pour les développer. De plus, la chaîne de valeur extrêmement variée (comprenant des groupes privés, publics, universitaires et d'intervenants) et nécessaire pour y parvenir est actuellement fragmentée. Sans progrès significatifs dans le domaine, la compétitivité de l'UE dans les secteurs scientifiques et industriels sera limitée.

L'initiative Transport routier sûr et automatisé tentera de renforcer la capacité scientifique et la compétitivité économique de l'UE, tout en contribuant à des bénéfices plus larges pour la société, notamment en termes d'impacts environnementaux et de sécurité routière. Cette initiative rassemblera des acteurs majeurs du secteur privé, des organismes de recherche, des autorités publiques et des groupes de représentants. Les résultats seront axés sur le développement technologique, la démonstration de conception de services et leurs impacts, et la coordination et l'intégration. La collaboration et l'influence d'acteurs externes au programme de base seront importantes, notamment l'alignement avec d'autres partenariats, l'intégration à des programmes de déploiement et aux stratégies des États membres et le soutien aux réglementations et aux normes émergentes.

Les options stratégiques pertinentes pour cette analyse étaient les appels à projets d'Horizon Europe uniquement, les partenariats co-programmés et les partenariats institutionnalisés. Nous avons conclu qu'un partenariat co-programmé était la meilleure option. Le partenariat co-programmé permettra d'améliorer significativement l'orientation de base, tout en permettant à l'approche de s'adapter au fil du temps, une flexibilité que le partenariat institutionnalisé ne peut garantir.

Cependant, le partenariat institutionnalisé présente des avantages qui pourraient s'avérer intéressants à l'avenir et il est conseillé de régulièrement le considérer comme une option à mesure que le partenariat évolue. Quand les impacts sur la société seront mieux compris et que les objectifs seront mieux alignés sur l'ensemble de la chaîne de valeur, le partenariat co-programmé pourrait être suffisamment stable pour créer une entreprise commune de plus grande envergure.

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Glossary

Automated Vehicle (AV)	It is generally accepted that there are 5 levels of vehicle automation. Vehicles with partial autonomy (levels 1, 2) are already available providing advanced driver assistance applications such as parking assistance, cruise control and emergency braking systems.
Connected Vehicle	A vehicle that usually has access to the internet and a variety of sensors, and is able to send and receive signals, sense the physical environment around them, and interact with other vehicles and / or infrastructure.
Co-operative ITS (C-ITS)	Intelligent transport systems that enable ITS users to cooperate by exchanging secured and trusted messages through the EU C-ITS security credential management system.
CCAM	Cooperative, Connected and Automated Mobility. The use of connected and automated vehicles to create more user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation. This requires a system approach to innovation, rather than developing automated vehicles by themselves. The focus is on road transport, but it takes into consideration relevant interfaces with other modes (for instance rail-way crossings, but also transfers and integration with public transport).
Digitalisation	In the context of transport, this is the adoption or increased use of digital (integrated advanced sensor, computer, electronic and communication) technologies and processes to promote safer, more efficient and sustainable systems for the movement of people and goods.
HMI	Human Machine Interface.
SDV	Self Driving Vehicle.

1 Introduction: Political and legal context

This document presents the impact assessment of the candidate institutionalised partnership Safe and Automated Road Transport, which is one of the initiatives that will enable implementation of the Commission's vision for the period beyond 2020 under the Horizon Europe Pillar II, specifically the Climate, Energy and Mobility Cluster. It is one of the envisaged European Partnerships in the Transport Partnership Area.

1.1 Emerging challenges in the field

The European Commission has identified Connected, Cooperative and Automated Mobility (CCAM) as a key enabler for both its mobility and industrial strategy as set out in its third mobility package, [1]and proposal for strategic value chains as part of Important Projects of Common European Interest.[2] The two strategies recognise the potential economic and societal benefits of CCAM including:

- road safety improvements;
- greater network efficiencies and reduced emissions;
- bringing mobility to people who cannot drive or are underserved by public transport;
- encouraging car sharing schemes and "mobility as a service"; and
- accelerating vehicle electrification and electro-mobility.

The strategies make clear the economic benefits to European industry across the value chain in serving the future CCAM market both internally within the EU and exporting products and services globally.

In order to deliver these strategies, there are challenges that need to be overcome and in particular that R&I will have a roll to help address. These challenges, and the actions required to overcome them, are set out in two key roadmap documents. They are the ERTRAC roadmap[3] and the STRIA roadmap.[4] The two roadmaps have been developed independently through separate pieces of work, with different organisations involved including private, public and higher education sectors. Other roadmaps have been developed at EU level including SCOUT (2018), CEDR (2016) and EATA (2019).

The challenges from the two roadmaps and the SCOUT roadmap (since the SCOUT roadmap sets out a comprehensive list of challenges) have been consolidated and are summarised in Table 1 overleaf categorised through the STEEP framework. Table 37 in Appendix D shows a more detailed mapping of the challenges across the three roadmaps.

In parallel to the publication of the roadmaps the European Commission has established the CCAM platform. The objective of the CCAM platform is to better coordinate CCAM

[1] European Commission, *On the road to automated mobility: An EU strategy for mobility of the future,* Brussels: COM(2018) 283 final, 2018

[2] European Commission, "Strengthening Strategic Value Chains for a future-ready EU Industry - report of the Strategic Forum for Important Projects of Common European Interest," 5 NOvember 2019. [Online]. Available: https://ec.europa.eu/docsroom/documents/37824.

[3] ERTRAC, "Connected Automated Driving Roadmap," 8 March 2019. [Online]. Available: https://www.ertrac.org/uploads/documentsearch/id57/ERTRAC-CAD-Roadmap-2019.pdf. [Accessed 23 September 2019].

[4] STRIA, "Roadmap on Connected and Automated Transort (Road, Rail and Waterborne)," April 2019. [Online]. Available: https://ec.europa.eu/research/transport/pdf/stria/stria-roadmap_on_connected_and_automated_transport2019-TRIMIS_website.pdf. [Accessed 23 September 2019].

development and pre-deployment and to create synergies in testing and implementation of CCAM in and between EU Member States, and with the industry.

Using the work from the roadmaps, and through further consultation within the CCAM platform, a single list of coordinated R&I actions, to help address the challenges, have been proposed (November 2019). They are discussed in greater detail later in this section and in Appendix D.

Table 1: Overview of the challenges emerging

Social	**Meeting societal needs:** Challenge of developing CCAM solutions that integrate with and meet wider societal needs including safety, mixed traffic, security, accessibility, inclusivity, wider transport systems and urban planning. **Assessment of societal impacts:** Difficulty in ability to predict and assess CCAM impacts on wider society including socio-economic impacts and how different groups will be affected (e.g. elderly, disabled and children). Difficulty can be caused by lack of well-defined CCAM use cases due to uncertainty in how CCAM solutions will evolve and be taken up. **Societal awareness and acceptance of CCAM:** Confidence and trust within society needs to be built for CCAM solutions and for new mobility forms to be taken up. This includes assurances over safety, security, ethical issues, data protection and privacy, and training/education.
Technical and technological	**Development of vehicle technology and safety critical systems:** Complexity in development of advanced CCAM solutions for high levels of autonomy including vehicle environment perception, event prediction, and decision making. Ability for advanced solutions to operate in different conditions including all weather scenarios and complex urban environments. Supporting safety processes including user condition/monitoring and sensing, handover, passive and integrated safety, reliability of the systems, and failsafe mechanisms. **Integration into the wider system:** Design and development of integrated physical and digital infrastructure and how data (including Big Data) can be safely and securing exchanged to support wider traffic management, supporting systems and post incident analysis. Challenges designing advanced CCAM solutions for use in mixed traffic situations, inc interaction with other non-motorised users (e.g. vulnerable users and animals).
Economic	**Commercially viable deployment:** Uncertainty over the future cost of high autonomy CCAM solutions leading to low confidence in business models to support commercial deployment. Uncertainty in business models includes cost of vehicle technology, cost and requirements of supporting infrastructure, how value of time will be affected, maintenance requirements, support staff and willingness to take up shared autonomous solutions. Also uncertainty about future roles of the different actors and stakeholders regarding costs. Responsibilities for maintenance of physical and digital infrastructure. Leads to uncertain investment strategies and uncertainty over level of public funding for supporting infrastructure. **Industry / Jobs / workforce:** Competitive global CCAM industry including rise of emerging economies in the last decade (e.g. China). Challenge for EU CCAM industry to maintain and extend industrial leadership in the competitive environment. Changing workforce requirements due to increased automation brought about by CCAM.

Environmental	**Increases in road transport:** Challenge to ensure CCAM does not incentivise transport choices that worsen environmental impact including switching to less sustainable transport modes/options and inducing additional road transport trips that would otherwise not be taken.
Political, policy and regulatory framework	**CCAM testing and approval:** Challenge in coordinating regulatory framework that ensures safe deployment of CCAM solutions. Including safety validation and framework for roadworthiness testing, functional safety standards, cross-border harmonisation, infrastructure (digital and physical) standards and vehicle type approval. **Protecting wider society:** Ensuring legal framework remains up to date and capable of protecting wider society including liability for system failure and user mis-behaviour, and changing responsibilities. Wider protections in place including ethical rules for data ownership/privacy, artificial intelligence, law enforcement procedures, and cyber-crime/terror. **Wider policy:** Difficulty in incorporating CCAM into wider policy when deployment and benefits aren't mature. Leads to lack of harmonisation of policy across geographies / sectors. Challenge of how best to write policy to protect against rebound effects including increases in person-kilometres by road transport and impact of empty vehicle trips.

Open Public Consultation

There was strong agreement between stakeholders in the Open Public Consultation (OPC) to aligning the direction of the R&I to EU policy objectives (including SDGs and climate related goals) and being more responsive to societal needs. There was particular support for R&I contributing towards EU global competitiveness where 89 out of 99 respondents identified this as either fully needed or needed. The view of competitiveness was shared across the sector including academic, private and public authorities. Overall less priority was given to supporting national and regional R&I strategies, although EU citizens and public authorities still identified this as needed.

Stakeholder interviews

The stakeholder interviews revealed significant support for the initiative to help deliver wider EU policies. In particular there was strong support for improving road safety, greater accessibility and more efficient traffic flows, and environmental benefits. Road safety held the greatest support with 37 out of 42 interviewees stating it was of high importance. These views, in general, were shared across the different stakeholder types, although public sector interviewees were in general slightly more sceptical of the immediate societal benefits, recognising significant work was required to align policy and technology research to ensure positive benefits were achieved in relation to traffic flow and environmental impact.

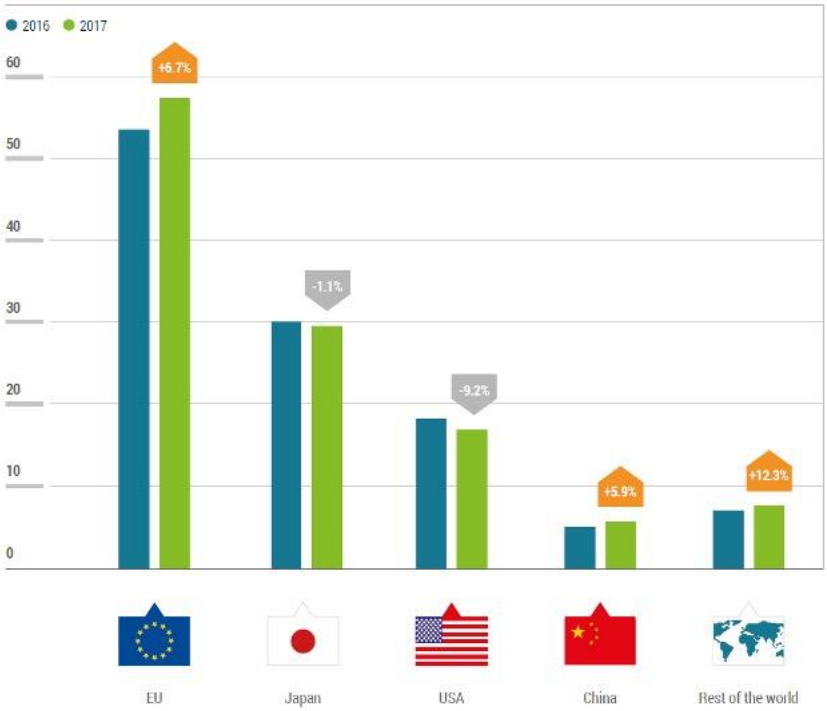
1.2 EU relative positioning

1.2.1 Competitive positioning of Europe in the field

This section presents Europe's positioning in the field in relation to R&D investment in the automobile sector, CAV readiness index reported by KPMG, patents filed, and smart transport publications.

In the most recent Automobile Industry Pocket Guide[5] published by the European Automobile Manufacturer's Association in 2019, R&D investment in the automobile sector between 2016 and 2017 is analysed. The data is taken from the EU R&D scoreboard publications.[6] Europe is ranked the highest region for R&D investment in the automobile sector investing about €58B in 2017 (an increase of 6.7% from 2016). Japan was the second highest investor with about €30B in 2017 (down 1.1% from 2016). The United States invested about €7B (down 9.2% from 2016) and China invested about €6B in 2017 (an increase of 5.9% from 2016). The data shows that the European automotive industry is the leader in R&D investment globally with about double the investment than the second placed region (Japan) and approximately the same investment to all other regions combined (see Figure 1 below).

Figure 1: R&D investment in the automobile sector (source ACEA Pocket Guide 2019-2020)



The findings of the KPMG report on Autonomous Vehicle Readiness Index[7] assesses how open and prepared 25 countries are to autonomous vehicles, organized into four pillars – 'policy and legislation', 'technology and innovation', 'infrastructure' and 'consumer acceptance'. The analysis is based on a mixture of surveys and desktop research. The average scores for EU member states compared with non-member states for the four different categories (and overall score) is shown in Figure 2. The EU outscores the other countries in all four categories. The EU is particularly strong in the areas of 'Policy and Legislation' and 'Infrastructure'. EU countries still lead in the areas of 'Technology and Innovation' and 'Consumer Acceptance' but the margin is smaller. Like the R&D investment

[5] European Commission, "Strengthening EU value chains for a future-ready EU industry," 05 11 2019. [Online]. Available: https://ec.europa.eu/docsroom/documents/37824/attachments/2/translations/en/renditions/native. [Accessed 23 01 2020].

[6] ACEA, "The Automotive Industry Pocket Guide," June 2019. [Online]. Available: https://www.acea.be/uploads/publications/ACEA_Pocket_Guide_2019-2020.pdf.

[7] European Commission, "EU R&D Scoreboard," 2018. [Online]. Available: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC113807/eu_rd_scoreboard_2018_online.pdf. [Accessed 23 01 2020].

statistics the EU scores are higher than other regions. Figure 3 shows the overall score by individual country. The Netherlands scored highest overall with Singapore second.

The KPMG report is not an exhaustive list since it does not cover all countries. Nonetheless, there is a sufficient sample size to provide good comparisons of Europe's positioning in the CCAM field.

Figure 2: KPMG Average AV readiness index by pillar

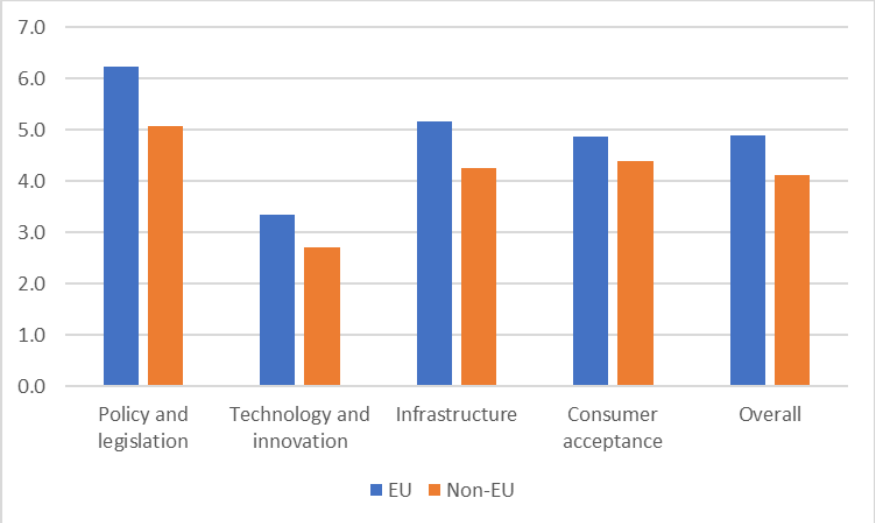
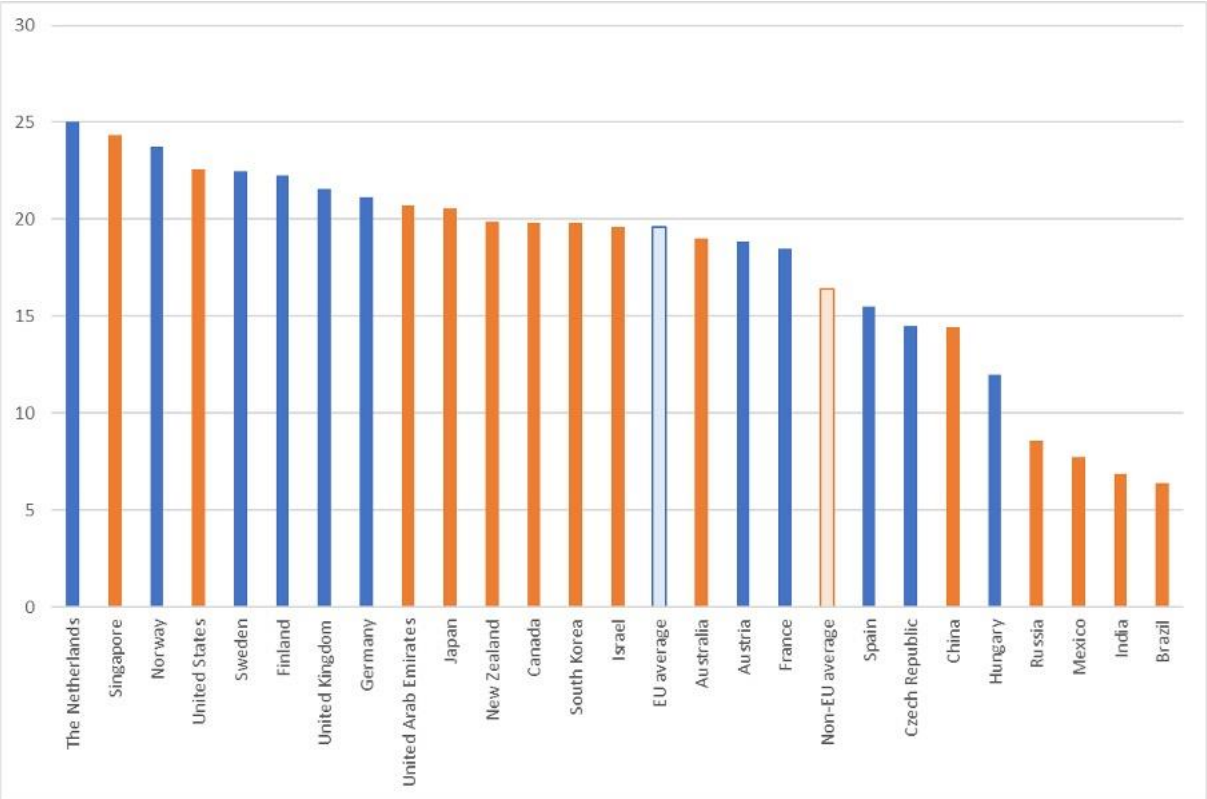


Figure 3: Overall KPMG CAV readiness score. Including EU average and Non-EU average.



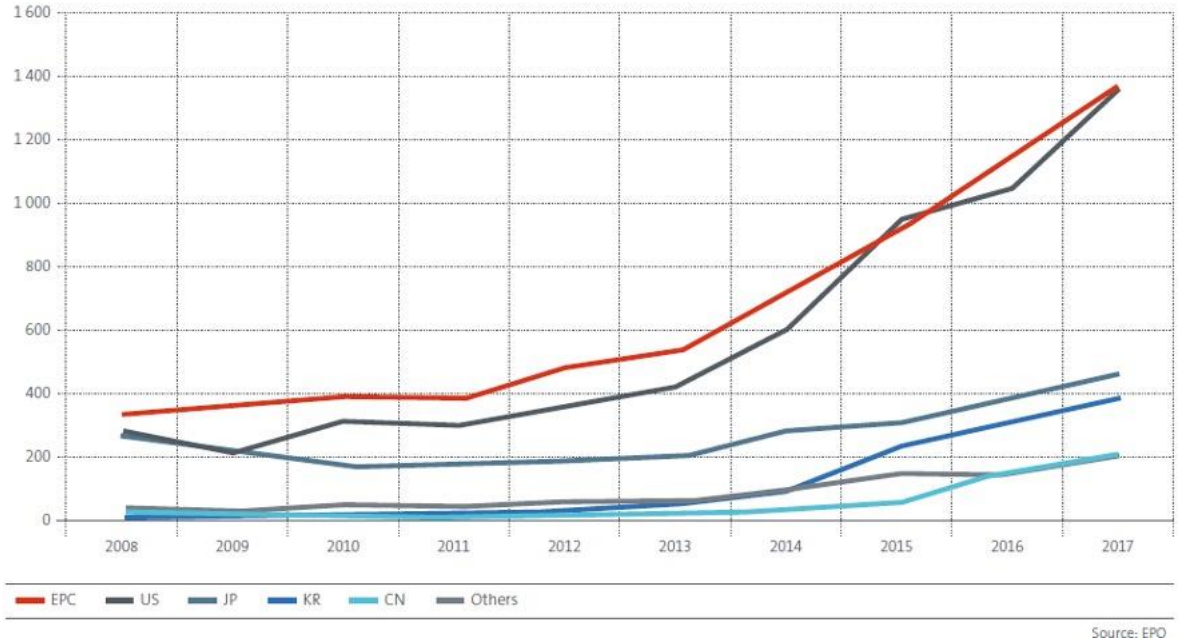
The EU is leading on the worldwide granting of patents, as shown in the Automobile Industry Pocket Guide[8] published by the European Automobile Manufacturer's Association

[8] ACEA, "The Automotive Industry Pocket Guide," June 2019. [Online]. Available: https://www.acea.be/uploads/publications/ACEA_Pocket_Guide_2019-2020.pdf.

in 2019. The EU made up 53% of patents in the automotive sector in 2018, with Japan second on 28%, the US on 12% and China on 1.8%.

More specifically in relation to self-driving vehicles the European Patents Office released a report in November 2018[9] summarising patent applications in Europe. Filed patents between 2011 and 2017 from companies based in European countries had the highest proportion at 37.2%, with the United States second with 33.7%. Japan had 13.3%, Korea 7.3% and China 3.2%. Figure 4 shows the patent applications at the EPO over time by region. The United States shows a sharp increase in patents from 2016 to 2017 joining level with the EU in 2017. Although China has a low number of patents overall it showed a sharp rise (quadruple) between 2015 and 2017 from 57 to 193.

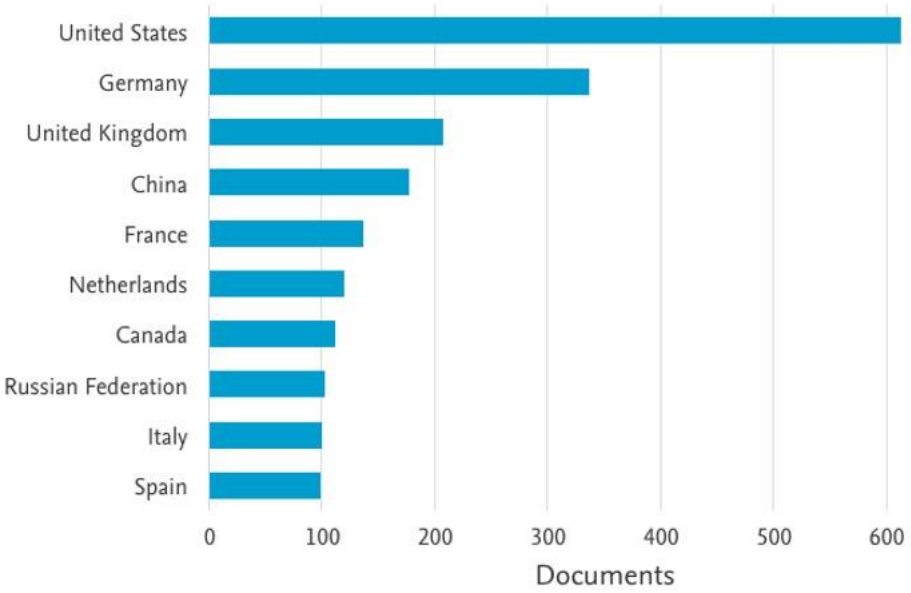
Figure 4: Origin of patent applications at the EPO in SDV technologies 2008-2017



In terms of academic publications, results suggest a very broad, worldwide, interest in CCAM and scientific competences in Europe, the Americas, and Asia. Between 2010 and 2018, 2,600 "Smart transport" publications were published (see Figure 5). The United States is currently the top publishing country, Germany is the second, and the United Kingdom is third. Of the top ten, six of the publishing countries are in Europe.

[9] EPO, "Patents and Self Driving Vehicles," November 2018. [Online]. Available: https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf. [Accessed 23 01 2020].

Figure 5: Main publishing countries in smart transport



The evidence across automotive R&D investment, CAV KPMG readiness index, filed patents and smart transport publications all suggest that the EU is leading the other regions in terms of current positioning in the field. However, there are notable individual "competitors" outside of Europe including the United States, Japan and Singapore. China is an emerging competitor as evidenced through the recent patent filing.

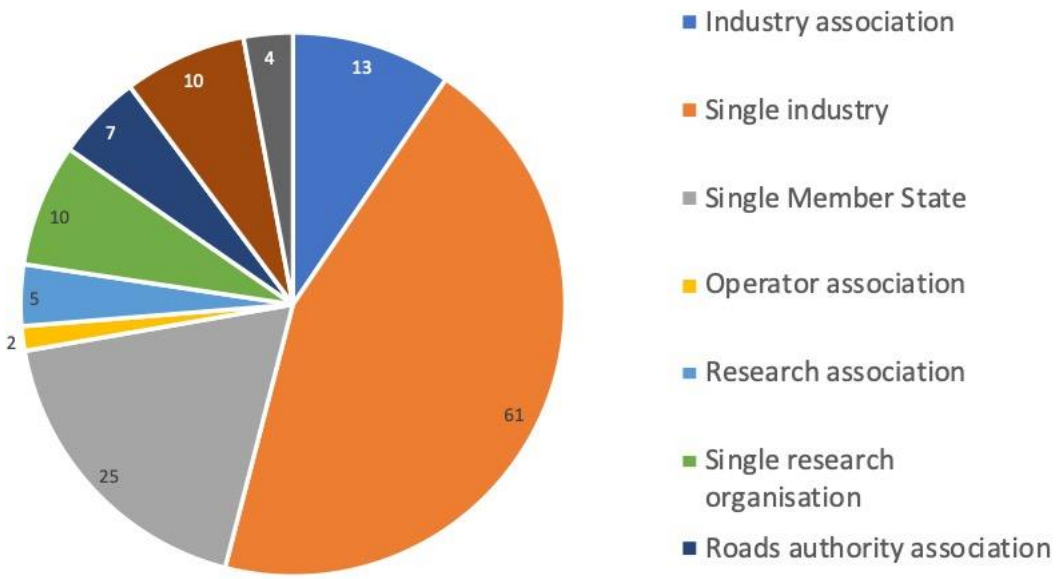
1.2.2 Support for the field in the previous Framework Programme

Support for the CCAM field in the previous Framework Programme is described below in three key areas: (1) coordination actions through the CCAM single platform, (2) actions under H2020 programme, and (3) CCAM funding outside of H2020. Supplementary information is provided in Appendix D.

Coordination actions under the CCAM single platform

The CCAM Platform was set up by the commission in June 2019 and consists of an informal group (including a signed MOU) of both private and public stakeholders. The group includes 137 organisations in the field of CCAM, covering a broad range of disciplines and interests, and are appointed for three years. The makeup of the group according to type of organisation is provided in Figure 6 below, with further information provided in Appendix D.

Figure 6: Makeup of actors in the CCAM single platform



The CCAM Platform Working Group 1 is developing a document to identify the platform's views on the objectives and priorities for a future EU agenda for research, testing and pre-deployment of CCAM. The main research areas of the CCAM platform R&I agenda is provided in Table 50.

Actions under the H2020 programme

As summarised in 'On the road to automated mobility: An EU strategy for mobility of the future',[10] between 2014 and 2020, a significant budget was allocated to support research and innovation on automated vehicles, with the focus areas including large scale demonstration pilots, user acceptance, design of a safe HMI, road infrastructure to support automation, and testing and validation procedures.

Initiatives funded under the existing H2020 programme that are determined to fall directly under the CCAM scope are projects coded in the TRIMIS database[11] as related to "connected and automated transport – road transport" and commenced from January 2015. These are referred to as the "CCAM H2020 projects" in the remainder of this report.

A breakdown of funding by stakeholder type is provided in Table 2 below.

Table 2: CCAM H2020 projects (2014 to 2020) total costs of R&I activities

Type of Organisation (as distinguished by CORDA)		Sum of Participant Total Cost	Percentage of Total Cost
PRC	Private Research (companies)	€ 332,229,490	61.2%
REC	Research Centres (public)	€ 107,725,506	19.8%
HES	Higher Education (universities)	€ 78,627,084	14.5%
PUB	Public, Non-Profit Organisations	€ 12,473,740	2.3%
OTH	Other	€ 12,031,293	2.2%

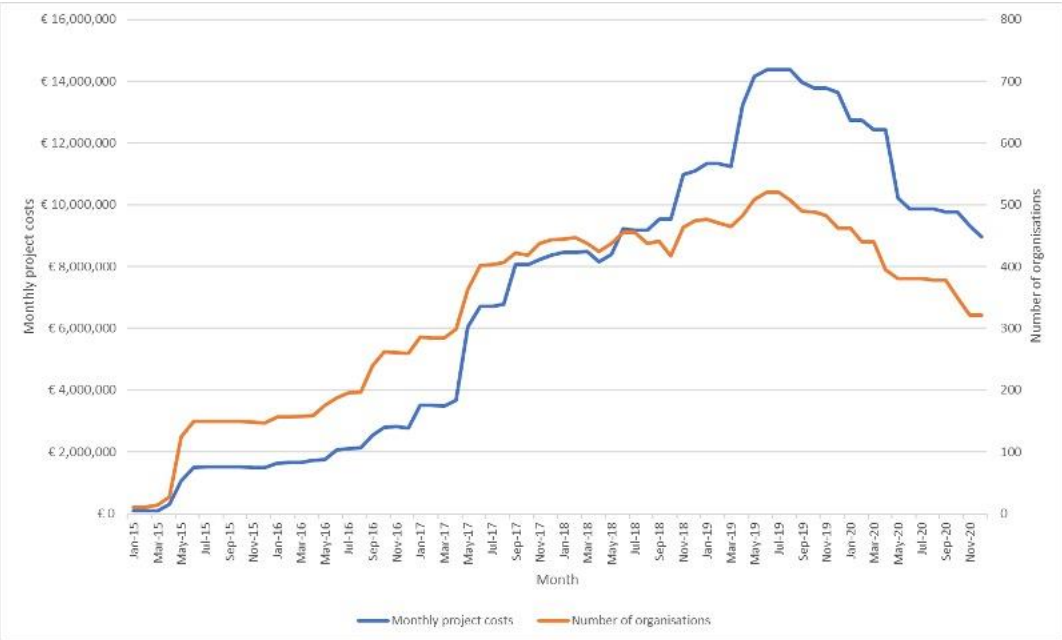
[10] European Commission, *On the road to automated mobility: An EU strategy for mobility of the future,* Brussels: COM(2018) 283 final, 2018.

[11] https://trimis.ec.europa.eu/

Type of Organisation (as distinguished by CORDA)	Sum of Participant Total Cost	Percentage of Total Cost
Total Spend:	**€ 543,087,113**	

Further categorisations and breakdowns are provided in Appendix D. German companies took the highest proportion of project costs at 28% (€151M). France was second highest at 10% (€52M). 17 different first level NACE categorisations were represented (Prof. S&T activities first at €170M and Manufacturing second at €152M), with 43 second level NACE categories represented. In total there were 630 individual organisations involved over the period. The monthly spend on CCAM H2020 projects, assuming an even distribution of costs throughout the duration of each project, is shown in Figure 7 below. There was a rise in CCAM R&I from January 2015 up to July 2019, peaking at €14.4M per month. Despite a rise in funding between from September 2018 the number of organisations remained fairly constant (between 400 and 500) suggesting additional funds were being channelled into the existing cohort.

Figure 7: Monthly project costs and number of organisations involved in H2020 projects



CCAM funding outside of H2020

The Connecting Europe Facility (CEF)[12] aims to develop trans-European networks for transport, energy and telecommunications. Some of the projects under the category of transport are likely to overlap with the area of CCAM. CEF supports, in particular, the implementation of projects which are aimed at the development and construction or upgrading of new infrastructures and services, giving priority to missing links in the transport sector. The total road transport CEF budget for 2014-2020 was €1.9B.

C-ITS services are expected to support CCAM operation in the medium-term, it is hoped that C-ITS, connectivity and automation will complement each other and eventually converge. The C-Roads platform that is funded under CEF is currently in the process of deploying Day 1 services including roadworks warnings, in vehicle speed limits and GLOSA.

[12] European Commission, "Establishing the Connecting Europe Facility," 11 12 2013. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32013R1316&from=EN. [Accessed 23 01 2020].

1.3 EU policy context beyond 2021

As set out in the report on the overarching context to the impact assessment studies, the R&I activities funded under the Pillar II Cluster Climate, Energy and Mobility aim at contributing to the attainment of at least three of the six main ambitions for Europe: 'A European Green Deal', 'a people-centred economy' and 'A Digital Europe'. It is supportive of several of the Sustainable Development Goals, particularly Climate Actions (SDG13) and Sustainable Cities and Communities (SDG11)

For the ***mobility sub-cluster,*** the analysis of potential synergies between the envisaged and candidate partnerships is shown in Figure 8. From this, it is obvious that there are a relatively high number of A187/CP types of candidate institutional partnerships in different mobility application areas (i.e. air, rail and road transport). It also highlights the twin challenges of digitisation and decarbonisation for future mobility and thus the potential synergies with the energy and digital sub-clusters. Finally, the European Open Science Cloud partnership will provide 'horizontal' (infrastructural) support to collaborative research and innovation within each envisaged partnership in Cluster 5, while also facilitating exchange and re-use of research data for the integration of new technologies into energy and mobility solutions.

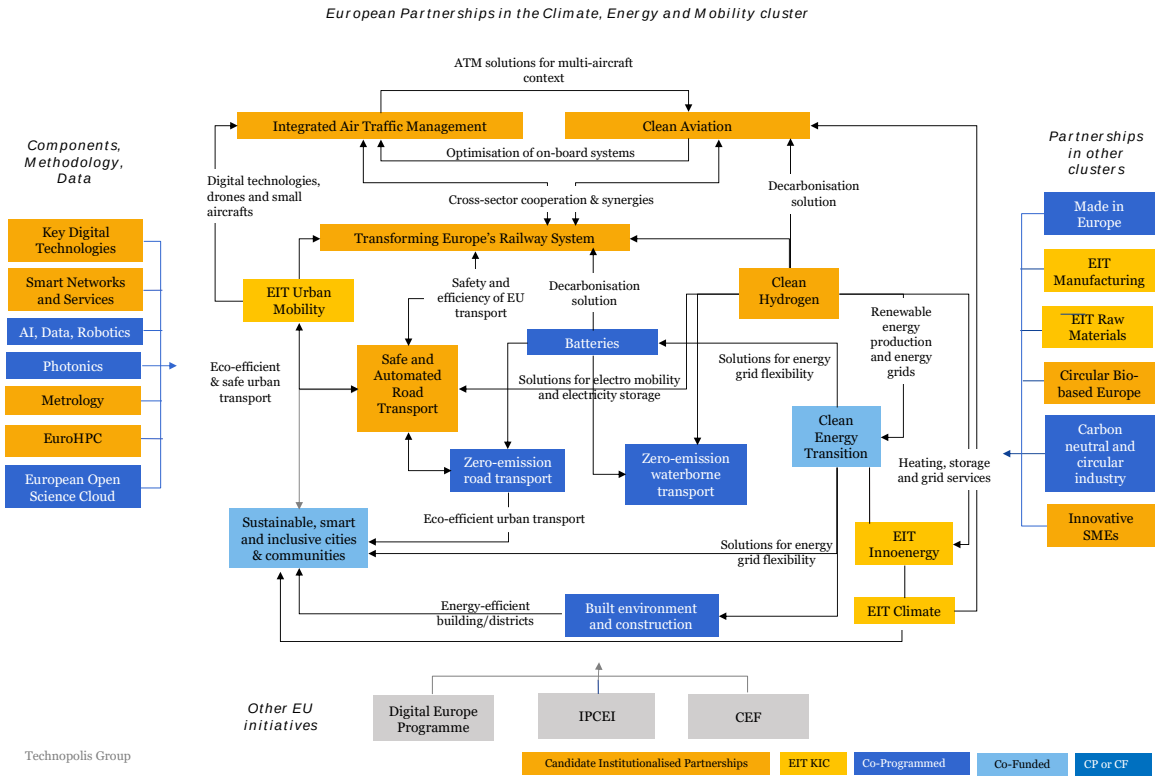
Figure 8, below, maps out the potential interconnections between the European Partnerships in the Climate, Energy and Mobility Cluster and between these partnerships and the ones in other clusters as well as the major other EU initiatives. What is less clear from this graphic is the lack of a cross-modal perspective approach to mobility across the four prospective A187/CP Partnerships as their titles imply different objectives and stakeholders. There are, however, several fairly obvious areas where there is surely scope for collaboration, if not rationalisation. These would include:

- 'Integrated air traffic management' will have an influence on 'clean aviation' but also has wider objectives related to a people-centred economy
- 'Safe and automated road transport' and 'zero-emission road transport' have some common industry stakeholders (i.e. vehicles) but one is orientated towards the digital industries and the other with the energy industries)
- 'Zero-emission road transport' and 'zero-emission waterborne transport' have supply chain synergies and challenges, particularly in relation to heavier duty applications

Another question is the extent to which the national/regional R&I funding agencies would be prepared to participate directly in A187/CP projects as this could enable better commercialisation links between the generally lower TRL projects that are funded by the public sector and provide a stronger market pull.

In relation to the other eU initiatives, it should be noted that there are strong linkages between the CCAV strategic value chain initiative and the CCAM R&I agenda, with complimentary and overlapping actions between the two, in particular facilitating and accelerating the pathway to greater deployment of CCAM solutions.

Figure 8: Interconnections between the envisaged partnerships in the Climate, Energy and Mobility Cluster



2 Problem definition

This section provides a discussion of the problems to be addressed in relation to the emerging challenges presented in Section 1.1, drawing on evidence from desk research and the findings of the stakeholder consultation undertaken as part of this study.

A problem tree portraying related problems, their drivers and consequences is presented in Figure 9 and described in detail in the following sections.

2.1 What are the problems?

2.1.1 P1: Fragmented research and innovation activities towards CCAM solutions in Europe, limiting their market-readiness.

As described in Section 1, the H2020 R&I projects associated to CCAM are spread out over the different work programmes and funding calls. The funding calls have not backed into a dedicated central CCAM roadmap, leading to fragmented R&I activities across the programme.

The CARTRE Coordination and Support Action and its follow up ARCADE have looked to bring together and help share best practice across the different H2020 CCAM projects including joint stakeholder workshops with ERTRAC to identify challenges, needs and recommendations for updating the roadmaps and project concertation workshops to identify synergies between project activities. The project has established the connected and automated driving website[13] which provides up to date news in the field of CCAM R&I, conference coordination, and databases of related projects and research. Dedicated conferences were held in April 2017, 2018 and 2019. The development of the Knowledgebase (which is online since September and still being updated with the support of CCAM platform members) is a first step in the coordination process within the objectives of ARCADE. The Knowledgebase shall support the identification of gaps, overlaps and

[13] https://connectedautomateddriving.eu/

potential synergies between projects. A next step is to derive lessons learned and best practices.

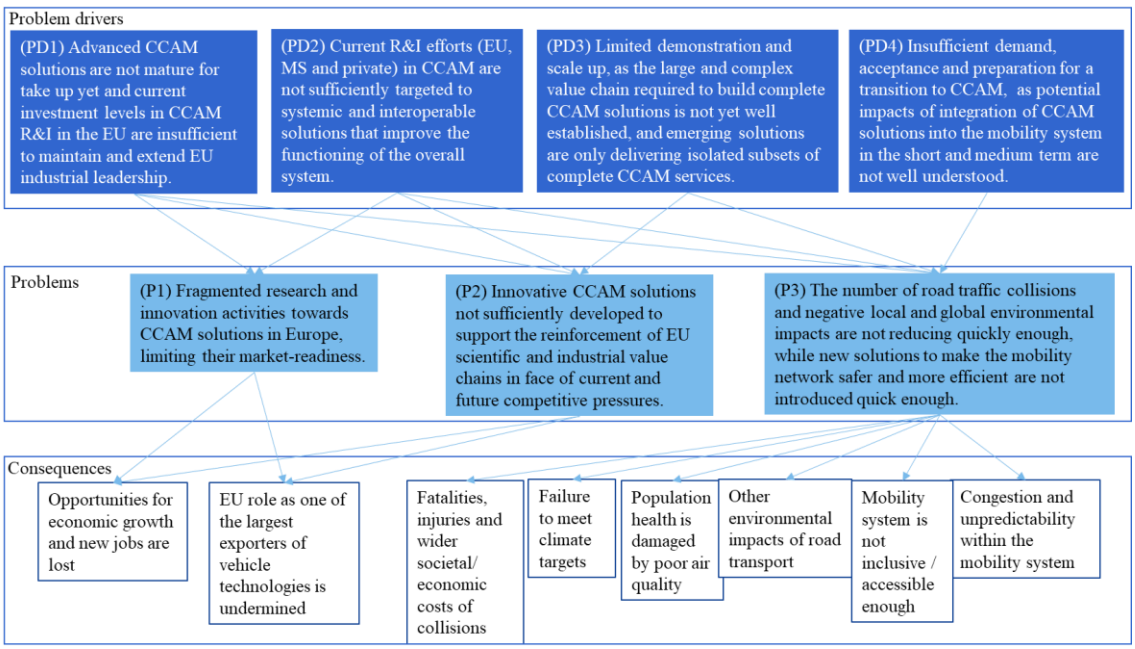
However, despite this coordinating activities and website, the individual H2020 projects, and wider CCAM R&I outside of H2020, are not tightly coordinated and streamlined. The CCAM roadmaps described in Section 1 were produced independently by different organisations / consortia in order to set out R&I activities required to further the development of CCAM solutions at EU level. Although some of the roadmaps reference each other there is limited obvious consolidation and alignment of their challenges, objectives and R&I actions, each one setting out a slightly different course of action. It is unclear as to the status of the different roadmaps, and which one (if any) is the definitive plan.

Furthermore, individual member states have published their own strategies/roadmaps and priorities for action. Some of these are listed below in Table 3 in reverse chronological order of their release. The strategies do not align to the overall EU R&I agenda, leading to a fragmented approach to overall CCAM development across the Union.

Table 3: Example individual member state CCAM strategies and roadmaps by year

2019	2018	2016	2015
Scotland	Austria	Spain	Germany
UK	France	Finland	

Figure 9: Problem tree for the initiative for Safe and Automated Road Transport



There is also a lack of alignment and disproportionate funding between Member State funded projects and EU funded projects addressing in particular harmonisation initiatives. For example, concerning the development of safety validation procedures, the German funded PEGASUS project has a total budget of about €36M with a funding of €16M, while the EU funded project HEADSTART has funding of €6M. Ireland has recently announced a €7M project to develop a CAV Test Bed with State Funding of €4M and Industry funding of €3M.

The CCAM single platform initiative, started in June 2019, is a start to coordinate and improve the R&I fragmented research and better align towards market readiness and deployment.

2.1.2 P2: Innovative CCAM solutions not sufficiently developed to support the reinforcement of EU scientific and industrial value chains in face of current and future competitive pressures.

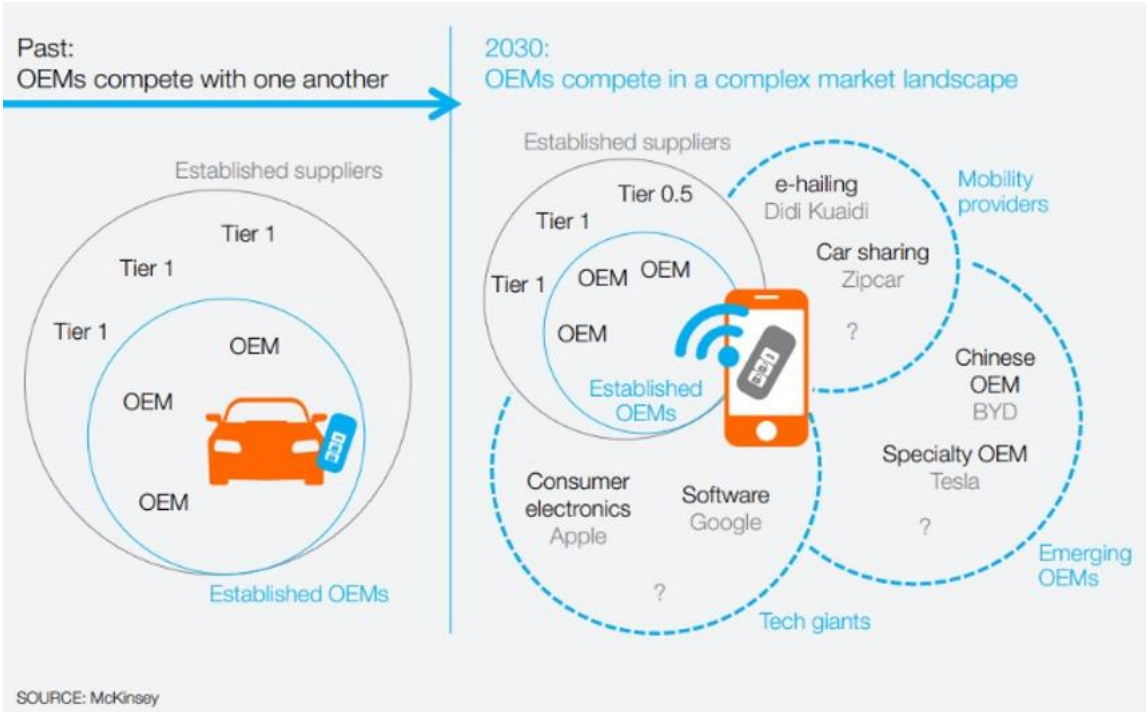
The CCAM R&I agenda sets out key actions required to develop CCAM solutions. These actions are categorised within three key areas of Technological Development, Service Design Demonstration & Impacts, and R&I coordination & Integration (see Table 50). The first area, Technological Development, includes R&I actions that are required to develop CCAM solutions to a level of sufficient maturity for them to be tested/demonstrated in public environments. The second area, Service Design Demonstration & Impacts, sets out activities to demonstrate the CCAM solutions in public environments, understand acceptance, and help inform future requirements. Demonstrations include shared automated mobility solutions, highly automated passenger vehicles and commercial/heavy duty vehicles. It also tests human-machine interaction and acceptance.

The development and coordination of these two areas is important to support the reinforcement of EU scientific and industrial value chains. i.e. development of advanced solutions, demonstrating them in public environments, informing new requirements, and then developing further solutions. However, to date the level of development of advanced CCAM solutions has been limited, resulting in limited demonstrations of the technology (further restricted by difficulty to get testing exemptions in many Member States, although efforts are being made by Member States to simplify the procedures and work is ongoing to update regulations). For example, one of the flagship H2020 demonstrator projects, L3PILOT,[14] (started September 2017, total project cost €68M), is yet to demonstrate the technology in public environments (including traffic jam, motorway, parking and urban use cases). The lack of sufficiently developed advanced CCAM solutions, and their demonstration (both at EU and global level), is holding back the development of the scientific and industrial value chain.

Current and future competitive pressures on the value chain are ever present, in particular from the United States, Japan and China. It can be observed that the IT industry – in particular the globally operating companies from Silicon Valley, but also the corresponding Chinese IT companies – have been crossing industry boundaries for some years and attacking the established automotive industry with new concepts of driving and using vehicles on the basis of their digital competence. Traditional vehicle manufacturers need to concentrate on developing and demonstrating a variety of new and emerging technologies in parallel with their present work. Developments in technology will substantially change the whole value chain, force OEMs and suppliers to form new partnerships and open the market for new rivals shown in Figure 10.

[14] https://www.l3pilot.eu/

Figure 10: Increasing complexity of market landscape (source: McKinsey 2016 [11])



2.1.3 P3: The number of road traffic collisions and negative local and global environmental impacts are not reducing quickly enough, while new solutions to make the mobility network safer and more efficient are not introduced quickly enough.

Between 2001 and 2010, the number of road deaths in the EU decreased by 43 percent and between 2010 and 2018 by another 21%. However, there were 25,100 deaths on EU roads in 2018 and as shown in Figure 11, progress in reducing road fatality rates has stagnated in recent years. It is considered highly unlikely that the EU will reach the medium-term target set in 2010 to half the number of road deaths between 2010 and 2020, while serious injuries only reduced by 5% between 2010 and 2017.[15]

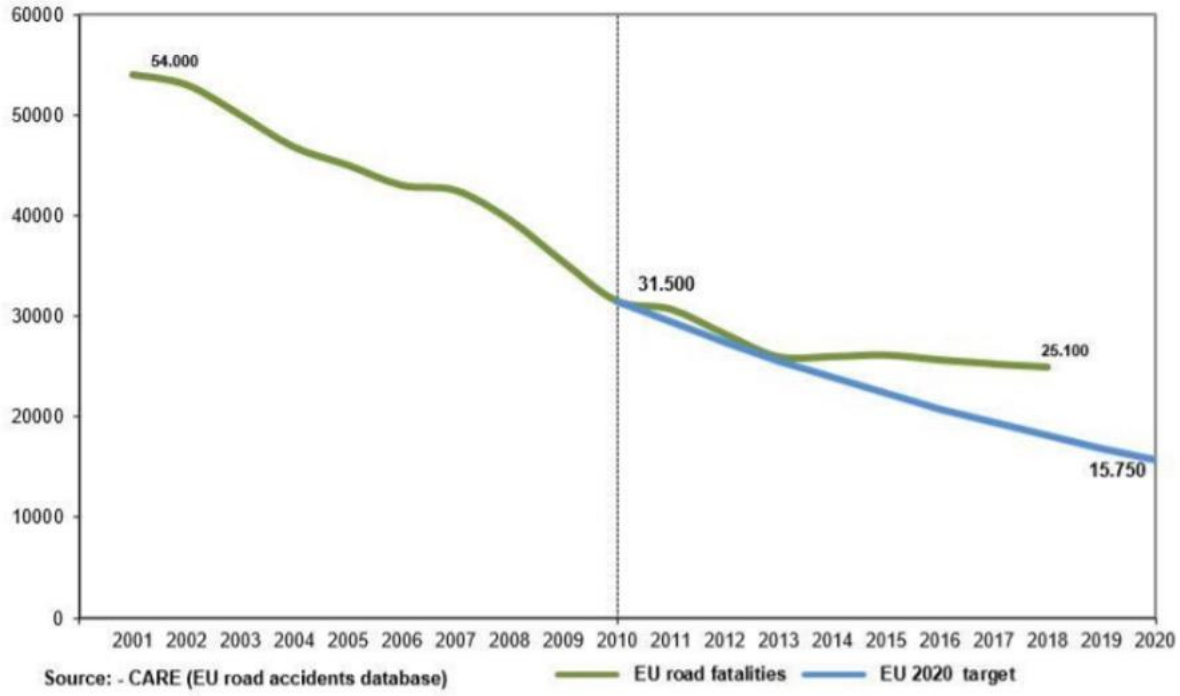
In this context, the long-term target of moving close to zero deaths by 2050, which was reaffirmed in the policy framework for road safety 2021-2030 released in May 2018 and is also referred to as 'Vision Zero', is very ambitious. Medium term targets have also been set to halve both the number of road deaths, and the number of serious injuries between 2020 and 2030.

The EU road safety policy framework for the next decade (2021 to 2030) covers numerous themes including infrastructure safety; vehicle safety; safe road use and emergency response. CCAM is one aspect of a wider 'safer vehicles' theme. 'Vision Zero' is a key driving force behind CCAM due to the opportunities it brings to reduce the role of human errors in collisions. A number of country specific studies have found that the majority of current collisions can be attributed to human error, including DEKRA Germany which estimated the proportion at 67%, RoSPA[16]UK (95%) and NHTSA [14] USA (90%).

[15] European Commission, "EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero"," 19 June 2019. [Online]. Available: https://ec.europa.eu/transport/sites/transport/files/legislation/swd20190283-roadsafety-vision-zero.pdf. [Accessed 20 September 2019].

[16] ROSPA, "Road Safety Factsheet," 11 2017. [Online]. Available: https://www.rospa.com/rospaweb/docs/advice-services/road-safety/road-crashes-overview.pdf. [Accessed 23 01 2020].

Figure 11: Evolution of EU road fatalities and targets for 2001-2020 (EU Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero")



The 2011 White Paper 'Roadmap to a Single European Transport Area' [17] sets a target to reduce greenhouse gas (GHG) emissions by 60% by 2050 compared to 1990 (corresponding to a 70% reduction below 2008 levels) and by around 20% by 2030 compared to emissions in 2008. This is also supported by the Low Emission Mobility Strategy (European Commission, 2016).

However, the Electric Vehicles from Life Cycle and Circular Economy Perspectives report by the European Environment Agency in November 2018 (European Commission, 2018) shows that although GHG emissions from transport decreased every year between 2007 and 2013, they have been rising again since that period and in 2017 were approximately 28% higher relative to 1990 levels. This increase has occurred despite improvements in the efficiency of vehicles and is broadly in line with increases in demand for both passenger and freight transport. In the same report a comparison of 2017 GHG emissions levels with the 2050 target shows a reduction of more than two-thirds of emissions compared with 2017 levels is necessary. Road transport accounts for 82% of transport GHG emissions and one fifth of the EU's total GHG emissions. With regard to emissions impacting air quality, road transport is responsible for 37% of NOx emissions and its contribution to harmful NO_2 concentrations is considerably higher, especially in urban areas. In addition to emissions arising from fuel consumption, non-exhaust releases such as primary PM (from tyre and brake-wear, and road abrasion) also contribute to local air pollution problems. Road traffic is also the most widespread source of environmental noise in Europe.

Another important negative impact of the existing inefficient mobility network is congestion, which is estimated to cost €100 billion, or 1% of the EU's GDP, annually (European Commission). A major contributor to congestion is that car travel remains the dominant passenger transport mode, accounting for over 70% of total passenger transport. Private cars use space and transport infrastructure very inefficiently compared to public

[17] European Commission, "White Paper Roadmap to a Single European Transport Area," 28 03 2011. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52011DC0144. [Accessed 23 01 2020].

transport and active modes and the level of inefficiency is exacerbated by low average occupancy of private cars and the demand for parking space.

While the electrification of road transport will help reduce impacts of road transport on climate change, air quality and noise, non-exhaust emissions and emissions from energy production will still occur and electric vehicles will not solve persistent problems of congestion and accessibility in urban and rural areas. Market penetration of electric vehicles also remains limited overall to date with high upfront costs being one of the key barriers. As outlined in the STRIA Smart Mobility Systems and Services Roadmap 2019 (European Commision, 2019), to reach transport decarbonisation goals, a fundamental transformation away from road based freight and individual motorised transport is likely to be required in addition to the rapid decarbonisation of primary energy supply.

Open Public Consultation

Stakeholders responding to the OPC confirmed the importance of these problems. A substantial majority of stakeholders identified fragmentation (including development of systemic and interoperable solutions, collaboration and pooling of resources, sharing expertise and building common testing frameworks). A lack of shared strategic planning of CCAM research and pre-deployment programmes was particularly recognised with 86 out of 102 respondents stating the problem was either relevant or very relevant to be addressed through R&I, and the view shared across different stakeholder types including academic, private and public sector companies.

Stakeholder interviews

Interviewees were in general very supportive of the problems listed in the questionnaire, in particular any problems relating to fragmentation of the value chain. For example 40 out of 44 interviewees rated "lack of coordinated R&I actions….." as either medium (12) or highly relevant (28), and 40 rated lack of strategic planning as either medium or highly relevant. These views were consistent across stakeholder types. Although not listed as a problem in the questionnaire 5 interviewees (2 PRC, 2 REC, 1 PUB) stated that policy and legislation is unable to keep up with the technology. A lack of definition or target for research, described by some as a 'common vision', was mentioned by 4 interviewees (2 PRC, 1 REC and 1 PUB), as was the need for sustainable and joint (in that it takes into consideration the needs of multiple stakeholders) business models (2 PRC, 2 REC).

2.2 What are the problem drivers?

The key problem drivers affecting R&I performance in the field of CCAM in Europe are discussed in more detail in the following paragraphs.

2.2.1 PD1: Advanced CCAM solutions are not mature for take up yet and current investment levels in CCAM R&I in the EU are insufficient to maintain and extend EU industrial leadership

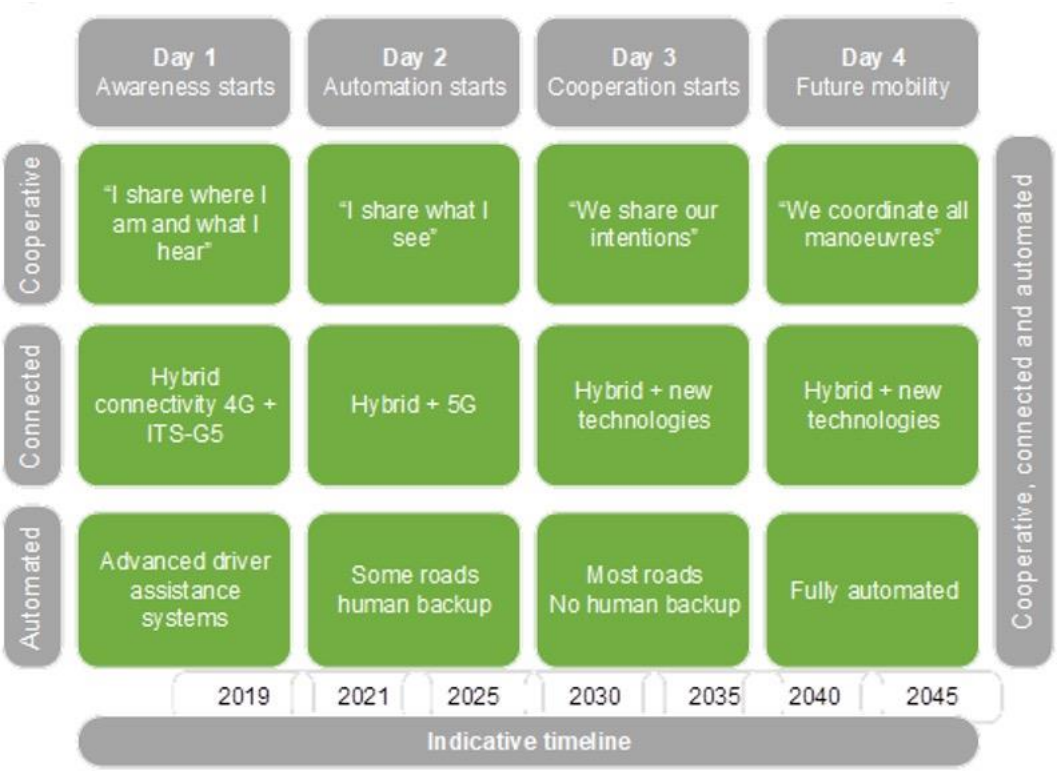
To describe this problem driver more fully we start by defining what advanced CCAM solutions are likely to be and compare the current state of the art and proposed R&I agenda against these definitions. We then set out the investment levels in CCAM R&I, and how it is insufficient to maintain and extend EU industrial leadership.

Advanced CCAM solutions

Figure 12, reproduced from a DG Move presentation at an InterCor conference in March 2019, shows how CCAM solutions (across Automated, Connected and Cooperative) are likely to progress and become more mature through their development. The timescales are indicative and provide context. Existing CCAM solutions are currently developed and available in the "Day 1" category, with cooperative elements defined in C-ITS standards and being tested through deployment activities. Day 1 automated elements are facilitated

through advanced driver assistance systems including traffic jam assist and highway chauffeur. Advanced CCAM solutions will be solutions at Day 2, 3 or 4.

Figure 12: Progression towards advanced CCAM solutions (reproduced from a DG Move presentation at an InterCor conference in March 2019



Current state of the art

The development and deployment of advanced CCAM solutions (i.e. beyond the "Day 1" services) are still being researched and planned. They are the focus of roadmaps produced at different levels including EU, Member States and representative bodies. For example, the STRIA roadmap (EU level) sets out the current technical challenges in the context of CCAM, stating the challenges spread across vehicles and infrastructure domains as well as communication and data processing. CCAM solutions consist of complex in-vehicle systems-of-systems with advanced sensors, extensive computational power and an increased dependency on software for decision making, control and actuation. Environmental perception is picked out as a particular technology that needs further development, describing the sensor suite across camera, lidar and radar and accompanying processing that can adequately classify objects and predict their behaviour under different Operational Design Domains (ODDs) including weather conditions. The supporting physical and digital infrastructure is recognised as a key technology to help facilitate greater maturity of advanced CCAM solutions and higher levels of automation including connections to the digital road infrastructure, external networks, systems, traffic management and the cloud.

The ERTRAC roadmap (representative body) also describes low maturity levels as key challenges and enablers for further development. In particular the roadmap picks out in-vehicle technology enablers and their development as crucial to enable CCAM. Developments in complex perception systems, new hardware concepts and vehicle localisation are identified. Other areas for future development include business models for new mobility services, big data, artificial intelligence and physical and digital infrastructure.

In September 2019 the Car2Car consortium released a roadmap [18] highlighting a C-ITS deployment strategy in which new generations of use cases and supporting functionalities could be increasingly introduced on top of the pre-existing ones and evolve in such a way to gradually enable cooperative automated driving. For next generation deployment (i.e. beyond Day1.5 which still need to be formally specified, see Appendix D) the roadmap indicates specific concepts to be better developed and associated issues to be addressed by dedicated competence groups. For deployment beyond Day 2, the white paper summarises the future scenarios to be considered as a result of the many ongoing R&D activities on related topics.

The CCAM single platform R&I agenda reflects these low maturity levels, and actions for increasing the maturity of CCAM solutions. The R&I agenda items include activities in environmental perception, on-board decision making, physical digital infrastructure and artificial intelligence. Large scale demonstration activities are proposed to integrate with the wider transport system and support wider take-up.

Insufficient investment levels in CCAM R&I in the EU

As described in Appendix D, investment under the H2020 framework from 2014 to present was €543M (€90M per year pro rata). Individual governments have been investing in R&I at a national level (e.g. in 2018 the UK government invested £25M in demonstrator projects,[19] and in April 2019 France stated it was investing up to €200M to launch and legalise autonomous shuttles.[20]

A report from the European Patent Office (EPO) on "Patents and self-driving vehicles"[21] reports a total of €50B of R&I investment in 2015 by the European automotive industry in established technologies for automobiles and other transport by EU companies. This €50B (taken from the EU Industrial and R&D Investment Scoreboard) does not include investment in associated CCAM technologies and includes elements such as signalling and lighting, braking systems, clutch controls, steering and chassis, suspension, etc.

The proportion of H2020 investment in CCAM, compared to the investment being made in established technologies is about 0.2%.

In order to maintain and extend industrial leadership investment in CCAM R&I will need to continue and increase.

2.2.2 PD2: Current R&I efforts (EU, MS and private) in CCAM are not sufficiently targeted to systemic and interoperable solutions that improve the functioning of the overall system

To describe this problem driver more fully we start by defining the current R&I efforts in CCAM, and then show how they are not targeted to systemic and interoperable solutions that improve the functioning of the overall system.

[18] Car2Car, "Guidance for Day 2 and beyond roadmap," 25 09 2019. [Online]. Available: https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_WP_2072_RoadmapDay2AndBeyond.pdf. [Accessed 23 01 2020].

[19] https://www.gov.uk/government/news/25-million-boost-for-self-driving-technology-apply-for-funding

[20] https://www.electrive.com/2019/04/25/france-e200m-to-launch-legalise-autonomous-shuttles/

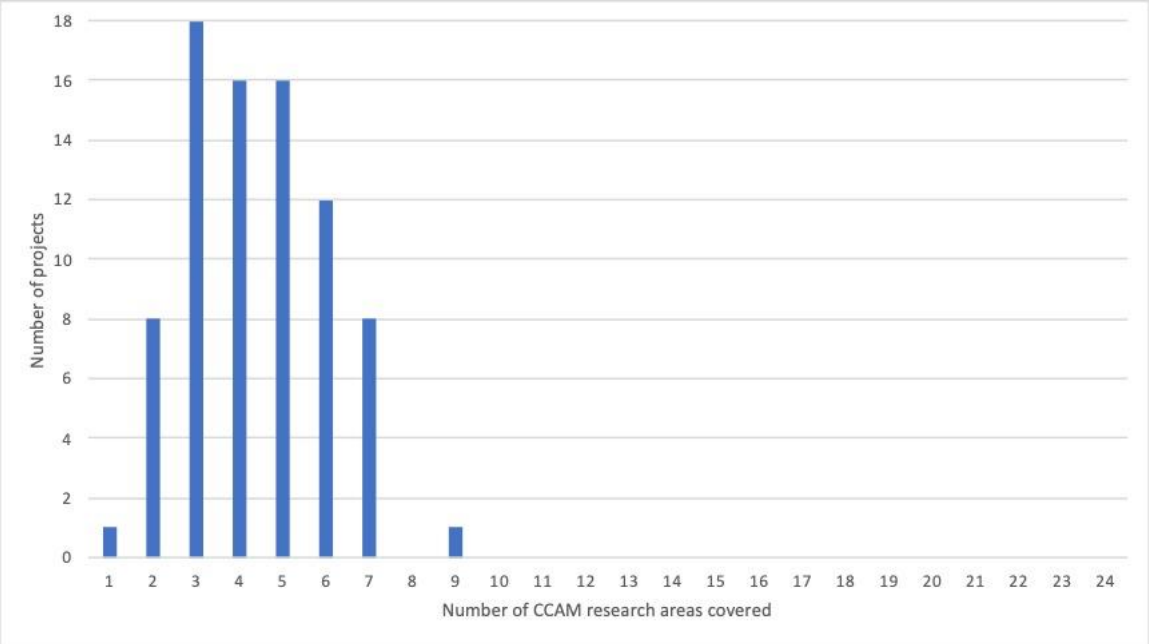
[21] EPO, "Patents and Self Driving Vehicles," November 2018. [Online]. Available: https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf. [Accessed 23 01 2020].

Current R&I efforts

Current R&I efforts in CCAM are undertaken at EU level (through Horizon 2020), at MS level through national initiatives, and by private companies / consortia. At the EU level the R&I actions are described in Section 1 with further information in Appendix D.

As shown in Figure 75 (a mapping of the H2020 projects against the current CCAM platform R&I areas), there is a broad range of technical areas/topics previous and current projects have covered. Out of the 24 CCAM platform R&I action areas, each project covers a subset of topics. Figure 13 below shows the number of H2020 research projects that cover a given number of CCAM R&I action areas. The majority of projects cover three areas (18 projects), and the overall average is 4.4.

Figure 13: Number of CCAM R&I research areas covered by projects under Horizon 2020



This shows that H2020 projects tend to cover a narrow range of R&I areas, focussing on specific objectives and research targets within the CCAM field. For this approach to target and support systemic and interoperable solutions, strong coordination is required between projects to help ensure learnings are shared between projects, partners and stakeholders. Furthermore greater efforts could be made to identify overlaps at an early stage when defining the calls for proposals to avoid duplication of efforts and leverage synergies where appropriate.

Through the ARCADE project news and project updates in the field of CCAM is disseminated through the website https://connectedautomateddriving.eu/. Coordination conferences occur, including "Results from road transport research in Horizon 2020 projects" organised by ERTRAC. Project concertation workshops are also organised – for example in April 2019 the ARCADE project gathered representatives from 40 projects from EU, US and Japan.

In additional to coordination, dedicated projects need to work on the development of harmonised frameworks as it is essential to have methodologies harmonised at least at EU level in order to have comparable results. The European Commission has provided funding for such harmonisation initiatives. For Impact Assessment and Safety Validation, such projects have started (LEVITATE developing a Policy Support Tool and a harmonised impact assessment framework, and HEADSTART defining a safety validation methodology). Both projects also include links to international activities, in particular in the US. Still however there are overlaps between these harmonisation initiatives and the activities carried out by ongoing projects or initiatives which had started working on harmonisation earlier. For

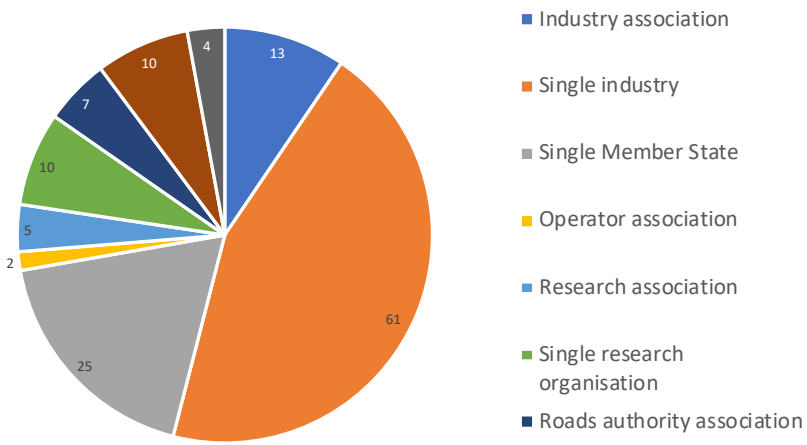
example, in the case of Impact Assessment, a dedicated Sub-Working Group exists on that subject within the Trilateral EU-US-Japan Working Group on Automation of Road Transport (ART) in which ARCADE is involved to organise EU stakeholders' involvement. An Impact Assessment Framework has been published by the group. A link has now been established between LEVITATE and the group.

Concerns over the coordination and direction of CCAM R&I remain and has resulted in forming of the CCAM single platform by the commission, as described in Section 1. More specifically Working Group 2 has been setup for the "Coordination and cooperation of R&I and testing activities".

2.2.3 PD3: Limited demonstration and scale-up, as the large complex value chain required to build complete CCAM solutions is not yet well established, and emerging solutions are only delivering isolated subsets of complete CCAM services

The value chain of CCAM is diverse, large and complex, involving many actors such as vehicle manufacturers, electrical component manufacturers, digital service providers, research centres, validators/regulators, road operators and municipalities. This is illustrated through the diverse participation in the CCAM single platform shown in Table 49 involving 137 different organisations. A high-level breakdown of the CCAM platform actors is shown in Figure 14 below.

Figure 14: Breakdown of current CCAM platform actors



From 2014 to 2020 there were 630 different companies involved in CCAM H2020 projects across 43 different NACE classifications.

The anticipated contribution to the CCAM R&I agenda by these different organisations is shown in Table 43 and Table 44, illustrating a wide crossover between public, private and research organisations, in particular on the "service design, demonstration and impact" category. Figure 67 and Figure 68 show the complexity of the value chain, with many linkages between different actors across the H2020 project portfolio. In a recent report from the JRC "Research and innovation in connected and automated transport in Europe"[22] some supplementary research was undertaken on H2020 projects associated with connected and automated transport in Europe. Figure 69 in Appendix D shows a breakdown

[22] European Commission, "Research and innovation in connected and automated transport in Europe," 2019. [Online]. Available: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC118270/jrc118270_20191213_cat_report_online_final.pdf. [Accessed 23 01 2020].

of framework programme projects by CAT technology, participants and value. This illustrates not only the diversity of research areas, but also the high number of actors involved in different activities. Figure 70 shows the development phases of the Top 10 researched CAT technologies in FPs. The vast majority of activities are focussed on research and validation activities, with a smaller proportion on demonstration and implementation.

The value chain is not only diverse, but roles are changing and thus concertation is required to agree and acknowledge these new roles and the responsibilities each stakeholder expects from the others (e.g. road operators to update digital infrastructure in addition to the physical infrastructure, etc).

In order to build complete CCAM solutions, input from all of these actors is required. Currently this value chain is not well established (for example the CCAM single platform was only set up in April 2019).

2.2.4 PD4: Insufficient demand, acceptance and preparation for a transition to CCAM, as potential impacts of integration of CCAM solutions into the mobility system in the short and medium term are not well understood.

The STRIA Roadmap on Connected and Automated Transport, the ERTRAC Connected and Automated Driving Roadmap, and more recently the JRC Future of Road Transport Report[23] set out numerous potential benefits of connected and automated driving, focused on how automation could contribute towards addressing a wide range of societal concerns including: road safety; the environmental impacts of road transport; congestion and the efficiency of the transport system; accessibility and social inclusion and productivity and comfort. However, while much of the discourse surrounding the anticipated increased deployment of automated road transport has been focused more strongly on potential benefits, there is a significant degree of uncertainty surrounding the potential impacts and there are some risks or possible disbenefits which could offset some of the potential gains or make some existing problems worse.

While cooperative communication and driver assist systems are likely to bring safety benefits, the fact that a significant number of road collisions involve human error is linked to an assumption that the deployment of automated vehicles will further improve road safety. However, this has not yet been proven through deployment and limited detailed studies are available. Recent research from TRL[24] concluded, out of a sample of 50 detailed accident records, 22% of records could have resulted in "no collision" if an automated vehicle were in control, while no conclusion could be drawn in the case of 20% of records which were categorised as "unknown". Research published by the International Transport Form at the OECD[25] concluded that: '*it seems likely that the number of road casualties will decrease with automation, but crashes will not disappear. In certain circumstances, more crashes may occur among "average" drivers that are not prone to risky behaviour. This is particularly likely in circumstances where drivers must take over from automated driving in emergency situations'*.

[23] European Commission, "The future of road transport," 04 2019. [Online]. Available: https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/future-road-transport. [Accessed 23 01 2020].

[24] TRL, "Automated Driving Systems: Understanding Future Collision Patterns," 12 2017. [Online]. Available: https://trl.co.uk/reports/automated-driving-systems-understanding-future-collision-patterns. [Accessed 23 01 2020].

[25] International Transport Forum, "Safer Roads with Automated Vehicles?," 2018. [Online]. Available: https://www.itf-oecd.org/sites/default/files/docs/safer-roads-automated-vehicles.pdf. [Accessed 23 01 2020].

The deployment of automated vehicles also creates other new road safety challenges. For example, there are significant gaps in knowledge regarding how automated vehicles will co-exist with non-automated traffic and with people walking and cycling. KPMG's global automotive executive survey[26] found that 71% of executives agreed that human driven and autonomous vehicles won't mix, and safety issues will result if the two are not separated. The quality of road markings and signs may influence the performance of automated vehicles and a lack of consistency in traffic rules across Europe creates challenges with regard to the need to avoid contradictions of national traffic rules and EU vehicle rules.

The STRIA and ERTRAC roadmaps anticipate that automated driving will decrease congestion through effective use of available road capacity and increased homogenous traffic flow. Related to this, the two roadmaps anticipate that achieving this higher level of efficiency and smoother traffic flow will also result in reduced energy consumption and emissions from road transport. The roadmaps also envisage that automated driving will have positive impacts for accessibility and social inclusion, in particular by providing an additional means of transport to elderly people and people with disabilities. However, while there is potential for positive impacts to be achieved which contribute to meeting overall societal goals, it is also possible that that increased deployment of automated mobility will have negative or mixed impacts, particularly with regard to transport network efficiency and environmental externalities. There is a risk that improved ease of access to and/or convenience of road transport, including potentially reduced costs, could result in an increase in the number of vehicles or vehicle km travelled, through a shifting of trips from high capacity public transport and active modes to lower occupancy vehicles and/or through induced demand. Road freight could also increase as a result of reduced costs.

The new shared automated mobility solutions which it is envisaged will be facilitated by new CCAM solutions have the potential to contribute to increasing the efficiency of the transport system, as well as improved accessibility and social inclusion, by improving the travel options available to people with reduced mobility and people living in low population density areas where the quality of conventional public transport provision is restricted by high costs. However, there are challenges associated with integrating these new solutions into existing transport systems in a way which fully captures their potential benefits. The STRIA 'Smart Mobility Systems and Services 2019 Roadmap' highlights the need to ensure new services, including shared and autonomous 'shuttles' are operated in coordination with public transport and strategically contribute to modal shift and to vehicle 'right-sizing'. Importantly, it notes that achieving this would also 'very much require the substantial expansion of high-throughput, high-speed public transport systems (i.e. rail, light rail and bus rapid transport)'. It cannot necessarily be assumed that this will be achieved based on experience to date, as the same report notes that deployment of new 'mobility-on-demand' services up to now has often been concentrated on providing additional access to car and road-based mobility without concurrently expanding public transport capacity and demand or ensuring mobility-on-demand is fully integrated with public services.

Ensuring that new shared automated mobility services improve accessibility for all users also presents challenges with regard to the wider roles drivers on public transport currently perform in supporting more vulnerable passengers and providing passive surveillance. There are also challenges with regard to costs and business models of new services, as to realise potential accessibility benefits to the extent envisaged, a significant reduction in

[26] KPMG, "Global Automotive Executive Survey 2019," 2019. [Online]. Available: https://automotive-institute.kpmg.de/GAES2019/downloads/GAES2019PressConferenceENG_FINAL.PDF. [Accessed 23 01 2020].

operating costs in comparison to the cost of conventional public transport provision would be required.

Based on the above considerations and uncertainties, it can be concluded that the actual impacts of increased automation on efficiency, the environment and accessibility will be strongly influenced by public policies at all levels of geography and the extent to which the right incentives, legal frameworks and policy measures are put in place to exploit potential benefits and minimise adverse effects. This has led to insufficient demand, acceptance and preparation for a transition to CCAM, as potential impacts of integration of CCAM solutions into the mobility system in the short and medium term are not well understood and/or unproven. Gathering of more evidence (e.g. data, trials and demonstrations) for a better assessment of the impacts of automation on the whole system, including urban space and citizens is required. For example, the JRC previously referenced on the Future of Road Transport propose to go beyond pilots and develop regulatory sandboxes and Living Labs where new technologies and mobility solutions can be tested with the engagement of citizens and other stakeholders, allowing them to observe and influence any possible implications.

Open Public Consultation

Widespread recognition of the importance of these problem drivers was reflected in the responses to the OPC. In addition to stakeholder agreement over the fragmentation issues, there was strong agreement over insufficient understanding of technical and non-technical requirements for CCAM services, and lack of consideration of societal needs. 78 out of 102 respondents agreed that the lack of consideration of societal or user needs including interaction with road safety, ethics and data privacy issues was either relevant or very relevant. These views were shared across public, private and research organisations, and all other categories.

Stakeholder interviews

Stakeholder interviews supported the problem drivers listed above. Outside of the fragmentation issues, interviewees identified the lack of consideration of societal needs as a significant problem, with 40 out of 44 identifying it as either relevant or highly relevant. This was shared across stakeholder types. There was strong acceptance across interviewees of lack of shared strategic planning and roadmap, with 40 out of 43 respondents identifying it as either medium or highly relevant. These views were particularly strong within the public and research centre stakeholder types with none stating they were of low importance, and 17 out of 26 stating it was of high importance.

2.3 How will the problem(s) evolve?

As outlined previously, many R&I actions are already taking place in this field, but they are taking place in a fragmented manner with respect to geographies, subsystems, sectors and different parts of the innovation lifecycle and value chain. In the absence of suitable EU action to address the overarching problems (i.e. a lack of investment in systematic and interoperable solutions, low market uptake and impact of R&I investments, and poor linkages with member state initiatives), it is likely that they will continue to exist in their current form, or to worsen, as the complexity of automated road transport and the associated high level of coordination of R&I activities and the significant investments which are required are unlikely be achieved.

R&I efforts will continue to be implemented in a fragmented way, resulting in a less than optimal level of investment, sub-optimal interoperability, as well as insufficient coordination between actors and across different sectors of the value chain. As a result of a lack of a common vision and insufficient collaboration between the public and private sector, societal and user needs may not be sufficiently considered and R&I investments may not be in line with wider EU policy objectives. Use cases developed by industries may

not align with the needs of public authorities (including local and regional ones), or new innovations may not be matched with the proper framework conditions, for example, in the regulatory domain.

In these circumstances, it is likely that innovation processes would not trigger the expected benefits and that Europe would miss the opportunity to benefit from CCAM solutions for its society and economy. Resources and investments committed to R&I activities could be wasted.

Open Public Consultation

Stakeholders responding to the OPC were not asked explicitly about how the problem might evolve in the absence of policy intervention. Those participating in the interview programme tended to support the view that the lack of progress in addressing the problems, including fragmentation and inadequate coordination of R&I activity observed under Horizon 2020, would likely continue in the absence of significant further policy intervention during Horizon Europe.

3 Why should the EU act?

In this section we cover only the subsidiarity question; the legal basis is identified in the EC Inception Impact Assessment.

3.1 Subsidiarity: Necessity of EU action

European collaboration is necessary to ensure CCAM solutions make the expected contribution to retaining Europe's competitive position in the market, reducing environmental externalities from road transport, improving road safety and increasing efficiency. These are all key EU priorities as outlined in previous chapters.

Although many R&I actions as well as large-scale tests in the field of CCAM are already ongoing in the EU at industry, local, national and EU level, the R&I is taking place in a fragmented manner, across geographies, subsystems and along the innovation lifecycle. A common vision and mechanisms to ensure interoperability and that R&I actions and their subsequent implementation are aligned are missing. The interoperability and continuity of mobility and transport services have a clear cross-border dimension and vehicles are also developed for the entire EU market and therefore these issues cannot be solved by individual Member States and industry. Without EU intervention, interoperability of products and services throughout the EU would not be ensured which would be a barrier to the functioning of the internal market and to the free movement of people. Therefore, it is vital for European industry and citizens that there is an alignment of R&I actions under a European strategy with a central coordination.

3.2 Subsidiarity: Added value of EU action

Action at EU-level would bring together fragmented efforts around the union towards a commonly set direction which would improve the functioning of the internal market by ensuring interoperability. It would also create the scale, critical mass and coordination of the different elements of the value chain which is required to strengthen competitiveness and to support the accelerated deployment of CCAM solutions.

In 'Strengthening Strategic Value Chains for a future-ready EU Industry',[27] a report of the Strategic Forum for Important Projects of Common European Interest, 'Clean, connected and autonomous vehicles' was identified as one of six strategic value chains which have

[27] European Commission, "Strengthening EU value chains for a future-ready EU industry," 05 11 2019. [Online]. Available: https://ec.europa.eu/docsroom/documents/37824/attachments/2/translations/en/renditions/native. [Accessed 23 01 2020].

significant potential to impact on Europe's industrial competitiveness, climate ambitions, strategic autonomy and security and upon which there is a willingness among Member States and industry to develop joint coordinated actions. Of the recommendations made in this area, 14 are of direct relevance to CCAM R&I, as shown in out of 44 of those relevant to CCAM, shown in Table 55.

Among these actions are funding (for R&D, to help SMEs and within the European Fund for Strategic Investments), standards (including for interoperability, MaaS, communication interface, data connection and storage, vehicle electronics), a European digital infrastructure and backend, certification and corresponding processes, common regulatory frameworks (to allow deployment of CCAM), large-scale verification, validation and deployment (including on cross-border corridors), platforms/agencies (to facilitate match-making between companies and private investors, to openly share data and information, to facilitate testing, for MaaS and for the skills sector to provide insights into current and needed skills capacities), common policy and instruments and other governance actions.

Inception Impact Assessment Consultation

There were 30 responses to the Inception Impact Assessment consultation. Of the 30 responses there was very strong support for EU action with 27 in favour of a partnership, and the remaining 3 not stating either way. Of the 27 responses supporting a partnership 18 preferred a co-programmed partnership, 2 preferred an institutionalised partnership, and the remaining 7 didn't specify. There was some evidence of a campaign across some companies within the automotive sector with 7 automotive private companies giving very similar responses.

Open Public Consultation

Among stakeholders responding to the OPC there was widespread recognition of the problems requiring intervention at the European level. Stakeholders participating in the interview programme and providing feedback on the inception impact assessment were also generally fully supportive of EU action to address these and other aspects of the problem.

Stakeholder interviews

Interviewees were asked to what extent action at EU level is needed to overcome the barriers, to which the majority answered that it is required. Combining results across each of the eleven problems and barriers discussed with interviewees, 304 out of 331 total answers were that EU action is required. They were also asked if an EU partnership is needed or would be helpful to overcome the barriers, to which 168 out 325 answers were that it is necessary and 146 out of 235 were that it would be helpful. Finally, interviewees were asked to what extent individual Horizon Europe calls could be enough to address the barriers. In line with the responses to the previous question, 243 out of 296 answers in total were that calls alone would not be enough.

The results for the question 'Considering the description received beforehand, which type of partnership would you consider is the most appropriate for the area of Safe and Automated Road Transport? - the preferred option was a co-programmed partnership with 20/33 of the interviewees that answered the question choosing 'Option 1'. This was followed by Institutionalised Partnership, for which 12/33 voted. 32 out of 33 voted in favour of a partnership of some form.

4 Objectives: What is to be achieved?

4.1 General objectives

In order to tackle the problems identified in Section 2, it is important to clarify the objectives of EU action in the field of research and innovation. We have identified three general objectives corresponding to the main problems discussed in Section 2.1.

The Safe and Automated Road Transport initiative is part of the Climate, Energy and Mobility cluster within the Horizon Europe programme. The objectives of this cluster are described in the report on the overarching context to the impact assessment studies.

The general objectives for the Safe and Automated Road Transport initiative have been developed and refined throughout the period of the study. Three general objectives have now been set which correspond to the Horizon Europe impact dimensions as follows:

Table 4: Safe and Automated Road Transport initiative general objectives

Ref	General Objective
GO1	Strengthen and integrate EU scientific capacities to support the creation, capitalisation and sharing of knowledge to accelerate the development and improvement of CCAM solutions.
GO2	Strengthen the competitiveness of EU CCAM value chains (including SMEs) accelerating the market entry of innovative, safe and clean solutions.
GO3	Contribute to increased efficiency of the mobility network and improve accessibility to mobility while reducing negative impacts, linked to accidents and environmental impacts.

As a result of the process of refinement which has been undertaken, the composition and precise wording of these general objectives differs slightly from those which were contained within the briefing material shared with interviewees in advance of the interviews undertaken to inform the study. However, the key themes and concepts included in the general objectives are not substantially different.

These general objectives are coherent with the Horizon Europe general objectives. The first and second general objectives (GO1 and GO2) for the initiative, are coherent with the ambitions contained within the Horizon Europe general objectives to "strengthen the scientific and technological bases of the Union and foster its competitiveness in all Member States including in its industry". The third general objective (GO3) for the initiative contributes to the Horizon Europe general objective of "tackling global challenges, including the Sustainable Development Goals" and also to the Horizon Europe general objective to "deliver on the Union "strategic priorities and contribute to the realisation of EU objectives and policies".

The initiative's general objectives address several Sustainable Development Goals (SDGs) including:

- Good health and wellbeing (SDG 3);
- Decent work and economic growth (SDG 8);
- Industry innovation and infrastructure (SDG 9);
- Sustainable cities and communities (SDG 11);
- Climate action (SDG 13); and
- Partnerships for the goals (SDG 17).

The good health and wellbeing" SDG incorporates targets to reduce fatalities from road traffic collisions as well as to reduce mortality from all forms of pollution. The third general

objective of the initiative as listed above is therefore well aligned with this SDG. This objective is also well aligned with the "sustainable cities and communities" SDG (SDG 11) and with the "climate action" SDG (SDG 13). The first and second general objective are well aligned with the SDGs for "decent work and economic growth" (SDG 8) and "industry innovation and infrastructure" (SDG 9).

4.2 Specific objectives

In order to achieve the general objectives, five specific objectives have been defined. These specific objectives respond to each of the problem drivers discussed in Section 2.2. The relationship between the general and specific objectives is shown in Figure 15.

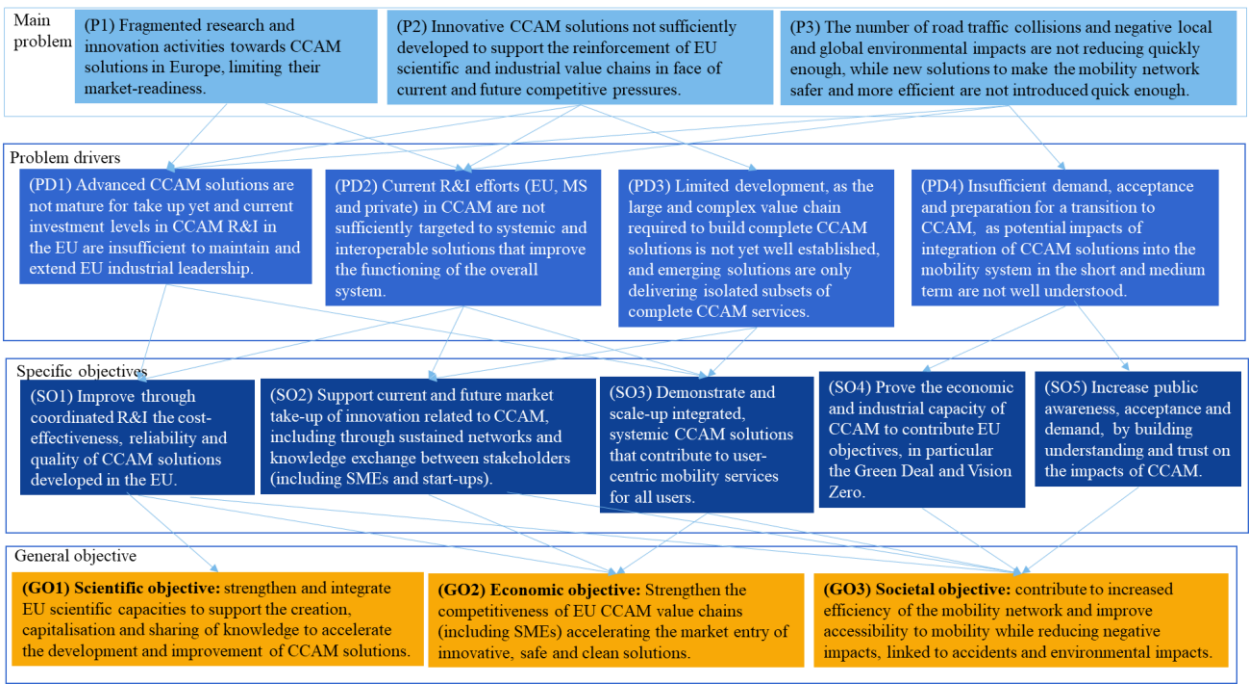
The specific objectives of the initiative describe how the proposed initiative will address the problem drivers in order to achieve the general objectives through more effective alignment of EU research and innovation efforts in the field. The specific objectives for the initiative have been developed and refined throughout the period of the study.

Figure 15 shows the intervention logic for the initiative to fund research in the field of CCAM. The first part of the intervention logic sets out the main problems and problem drivers which were discussed previously in Sections 2.1 and 2.2. The figure shows how each of the five specific objectives for the initiative will address each set of problem drivers.

The three general objectives for the proposed initiative have been positioned at the end of the intervention logic. By achieving the specific objectives, the proposed initiative is expected to achieve a better alignment of EU research and innovation efforts related to CCAM in a way which results in positive impacts for the performance of the mobility network (with regard to efficiency, environmental externalities and other societal needs). The successful implementation of the initiative is also expected to ensure enough critical mass in Europe for the development of solutions to improve road safety and to improving maintaining and extending the industrial leadership of European industry in CCAM.

The remainder of this section lists which specific objectives map to the subheadings of "scientific objectives", "economic/technological objectives" and "societal objectives". However, most of the specific objectives fit into more than one of these categories, as they will contribute to achieving results across multiple impact pathways.

Figure 15: Objectives tree for the initiative for Safe and Automated Road Transport



4.2.1 Scientific objectives

The specific objectives of the Safe and Automated Road Transport initiative which are most relevant to achieving the "scientific" impacts are:

- SO1 - Improve through coordinated R&I the cost-effectiveness, reliability and quality of CCAM solutions developed in the EU.
- SO3 - Demonstrate and scale-up integrated, systemic CCAM solutions that contribute to user-centric mobility services for all users.
- SO4 - Prove the economic and industrial capacity of CCAM to contribute to EU objectives, in particular the Green Deal and Vision Zero
- SO5 - Increase public awareness, acceptance and demand, by building understanding and trust on the impacts of CCAM.

4.2.2 Economic/technological objectives

The specific objectives of the proposed initiative which are most relevant to achieving the "economic/technological" impacts include:

- SO1 - Improve through coordinated R&I the cost-effectiveness, reliability and quality of CCAM solutions developed in the EU.
- SO2 - Support current and future market take-up of innovation related to CCAM, including through sustained networks and knowledge exchange between stakeholders (including SMEs and start-ups).
- SO3 - Demonstrate and scale-up integrated, systemic CCAM solutions that contribute to user-centric mobility services for all users.
- SO4 - Prove the economic and industrial capacity of CCAM to contribute to EU objectives, in particular the Green Deal and Vision Zero
- SO5 - Increase public awareness, acceptance and demand, by building understanding and trust on the impacts of CCAM.

4.2.3 Societal objectives (including environmental and social objectives)

The specific objectives of the proposed initiative which are most relevant to achieving "societal" impacts include:

- SO2 - Support current and future market take-up of innovation related to CCAM, including through sustained networks and knowledge exchange between stakeholders (including SMEs and start-ups).
- SO3 - Demonstrate and scale-up integrated, systemic CCAM solutions that contribute to user-centric mobility services for all users.
- SO4 - Prove the economic and industrial capacity of CCAM to contribute to EU objectives, in particular the Green Deal and Vision Zero.
- SO5 - Increase public awareness, acceptance and demand, by building understanding and trust on the impacts of CCAM.

Open Public Consultation

As noted in Section 1 stakeholders across the different groups, including business organisations of different sizes, business associations, academic and research institutions, public authorities and EU citizens, largely endorsed the view that R&I should be responsive to societal needs and make a significant contribution to global competitiveness (both on the scientific and economic/technologic impact pathways).

Stakeholder interviews

All interviewees were supportive of the objectives listed in the questionnaire which closely align to both the general and specific objectives of the partnership. In particular there was very strong support from interviewees for the partnership to target road safety improvements (37 out of 42 stated it was of high importance with none saying it was low importance). This was shared across stakeholder types.

4.3 Intervention logic and targeted impacts of the initiative

4.3.1 Likely scientific impacts

The initiative is likely to lead to three key scientific impacts, as illustrated in Figure 16 and further described below.

Figure 16: Impact pathway leading to scientific impacts

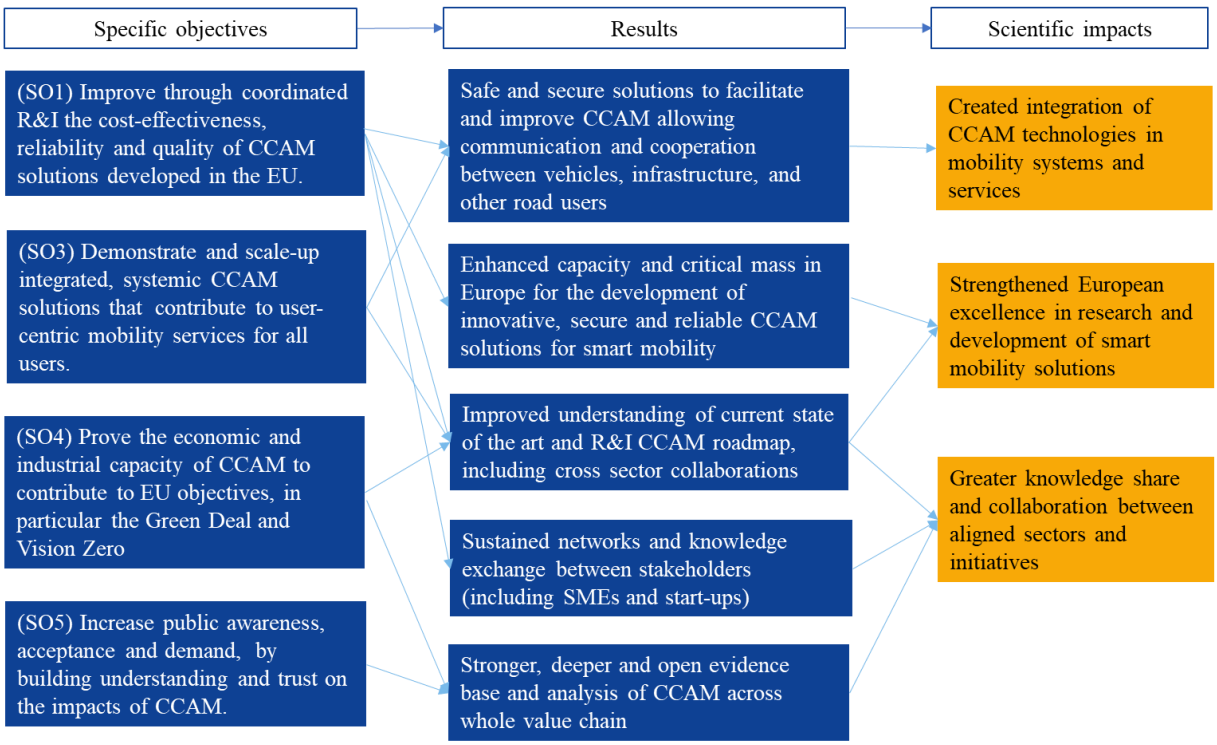


Figure 16 shows the proposed scientific impact pathways for the initiative. If successful the initiative is expected to create integrated CCAM technologies in mobility systems and services, strengthened European excellence in research and development of smart mobility solutions, and greater knowledge share and collaboration between aligned sectors and initiatives.

Integration of CCAM technologies will primarily be achieved by improving coordination of CCAM R&I (SO1) and greater demonstration and scale up of integrated, systemic CCAM solutions (SO3).

The initiative will achieve strengthened European excellence in research and development in the field of CCAM solutions by enhancing R&I capacity and critical mass in the field, and

through an improved understanding of current state of the art including a clear R&I roadmap.

The size and complexity of the CCAM value chain and the challenges involved in integrating CCAM solutions into the existing mobility system, as discussed in previous chapters, necessitate a more integrated approach to addressing R&I challenges than has existed to date. The initiative will involve a large number of actors from the private and public sectors who need to be involved in the development, large-scale testing and validation of solutions to address technical and non-technical challenges. Ideally concertation should be encouraged/supported between funding entities in Member States and EU for alignment of overarching topics and harmonisation efforts. All actors will pursue common objectives and clear deliverables, and this will avoid fragmentation, duplication, inconsistencies and gaps. Greater knowledge sharing between aligned sectors and between CCAM initiatives and other related initiatives will be achieved. This will include common methodologies and procedures for e.g. the assessment of impacts, ensuring comparability of results at European and even international level, and sharing of experimental procedures.

Open Public Consultation

In the OPC two scientific impact pathways were canvassed for relevance and both scored highly amongst stakeholders. They were in relation to scientific knowledge/capability and scientific cooperation and they closely align to the second two scientific impact pathways of strengthened European excellence and greater knowledge share shown in Figure 16. On both impact pathways 78 out of 102 respondents stated it was either relevant or very relevant for the initiative to deliver on the impacts. This view was shared across all stakeholder types.

Stakeholder interviews

Interviewees were supportive of the partnership to establish sustained networks and knowledge exchange between stakeholders, with 41 out of 42 interviewees stating it was either medium or highly important. However even though public sector interviewees still identified scientific pathways as important, they tended to be rated of medium importance rather than highly important. Public sector interviewees tended to favour the societal impact pathways more.

4.3.2 Likely economic/technological impacts

The likely key economic/technological impacts of the initiative are mapped in Figure 17.

Figure 17: Impact pathway leading to economic/technological impacts

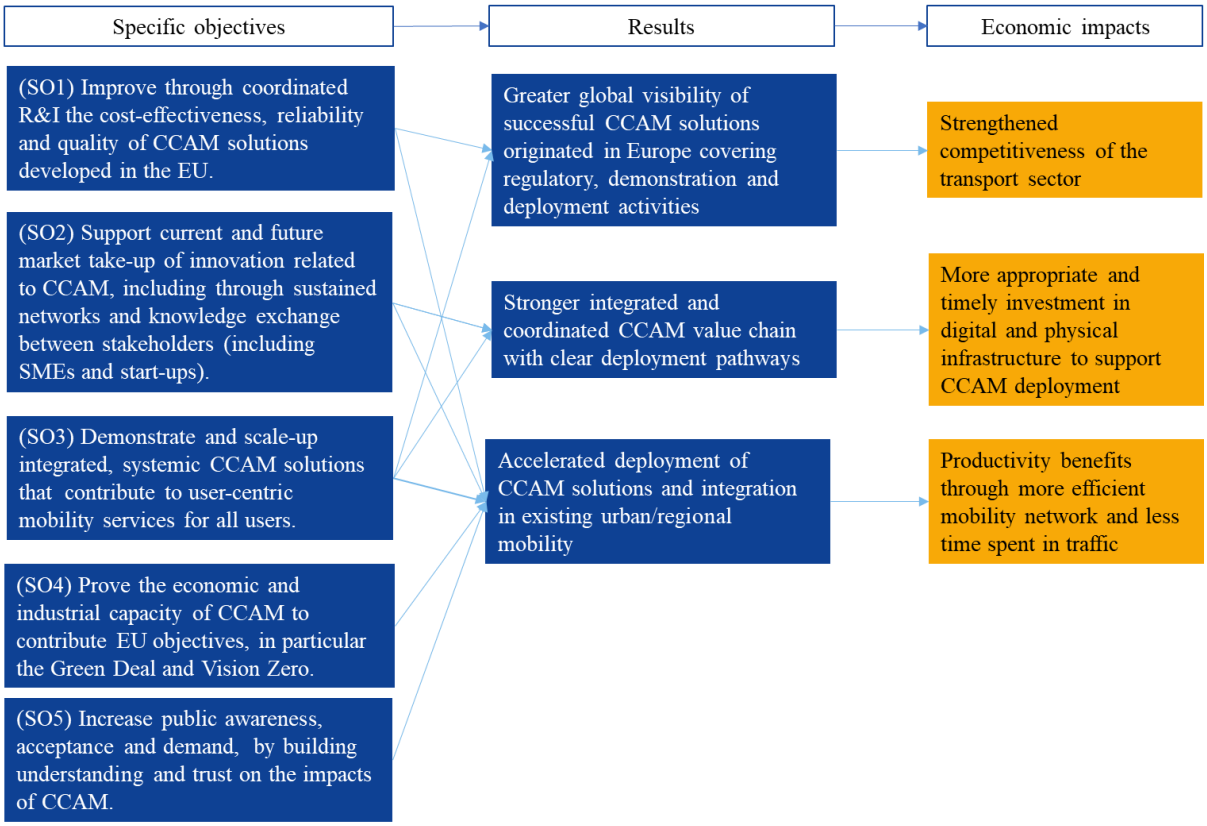


Figure 17 shows the proposed economic/technological impacts for the initiative. If the initiative is successful, the key economic/technological impacts it should achieve are the strengthened competitiveness of the transport sector, more appropriate and timely investments to support CCAM deployment, and productivity benefits.

The competitiveness of the European transport sector will be strengthened through the greater global visibility of successful CCAM solutions originated in Europe covering regulatory, demonstration and deployment activities which will result from achieving SO1. The initiative will provide support for the current and future market take-up of innovation (SO2), which will also result in greater global visibility of successful CCAM solutions originating in Europe, resulting in strengthened competitiveness. In combination, these results will put the EU industry and service provision market in a stronger position to export outside the EU, enhancing the creation of new jobs and business opportunities in the sectors which benefit.

By demonstrating and scaling up integrated, systemic CCAM solutions (SO3) and supporting current and future market take up (SO2), the initiative should lead to stronger integrated and coordinated CCAM value chain with clear deployment pathways. This will lead to more appropriate and timely investment in digital and physical infrastructure to support CCAM deployment.

SO4 and SO5 focus on the need to ensure the CCAM solutions deployed raise awareness and meet wider societal needs. Raising awareness and including citizens in the definition of requirements and policy developments will help prepare people to be ready to use CCAM solutions and thus support their wider uptake.

A positive impact related to this objective which is particularly relevant to the economic impact pathway is the productivity benefits resulting from reducing the time individuals and goods need to spend driving and/or travelling in general, and reliability improvements. Productivity benefits could take the form of additional time spent working in some cases, particularly in the case of employees who travel for work purposes, but productivity benefits should also arise from improved employee wellbeing.

The impact of reduced time spent driving will be achieved in a number of different ways and will change over time and vary between different geographic contexts. Initially CCAM solutions can contribute to ensuring the more efficient operation of existing road networks through smoother traffic flows which can positively impact congestion, journey times and reliability for people and goods. In the longer term, highly automated vehicles would free up people's time for tasks other than driving which would allow them to use their time more effectively while travelling, even if using private vehicles. There is some risk that the benefits of this would be diminished if increased convenience of travel in an automated vehicle resulted in an increase in distance travelled by private and low occupancy vehicles (and inducing additional trips that would otherwise have not be made) and an associated increase in congestion and journey times. However, it is expected that automation could also facilitate new shared mobility solutions, and these can significantly contribute to improved overall transport network efficiency, provided the right policies and incentives are in place to ensure that they are well integrated into an overall mobility system and complement high-throughput public transport and active travel modes. In particular for the first and last mile parts of trips and to connect urban periphery or rural areas to the public transport network.

CCAM benefits will also be significantly enhanced when integrated with existing and future public transport systems and with traffic management systems and processes. This means R&I and pre-deployment actions should also look at supporting municipalities and operators in identifying the best approaches for integration and the most suitable use cases. An example of this is the SPACE project from UITP[28] which is aimed at helping build an integrated combined mobility system. It is helping inform operational aspects to help cities and authorities prepare for piloting and deployment.

Open Public Consultation

In the OPC seven economic/technological impact pathways were canvassed for relevance. The most prominent impact supported by stakeholders was "more innovative, sustainable and globally competitive CCAM industry" which closely aligns to the first impact pathway in Figure 17. 85 out of 102 respondents stated it was either relevant or highly relevant with very strong alignment across all the stakeholder types. 64 out of 102 respondents marked either relevant or highly relevant the impact of "reduced risk of investment in innovative solutions", which reasonably aligns to the second impact pathway of "more appropriate and timely investment in digital and physical infrastructure" with consistent views across the stakeholder types.

Stakeholder interviews

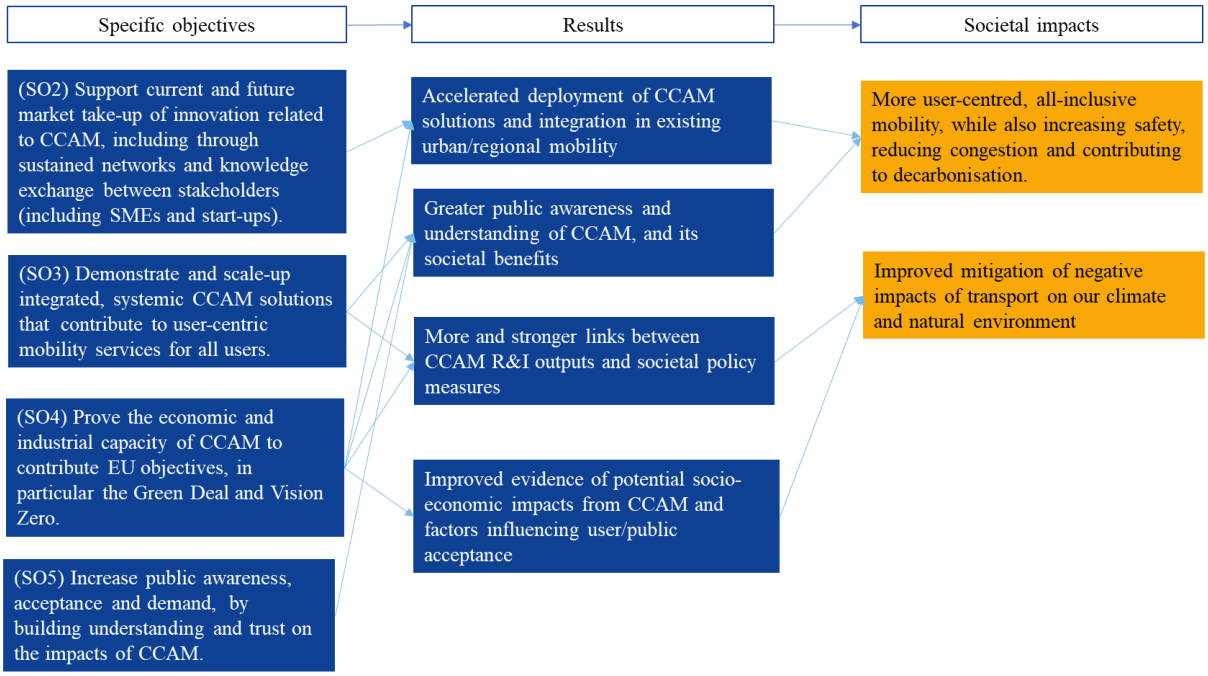
Interviewees were supportive of the economic impact pathway objectives. For example 37 out of 42 interviewees stated that contributing to maintaining and extending industrial leadership was either medium or highly important. These views were shared across all stakeholder types, but particularly the private research stakeholders, where 10 out of 16 stated this was highly important.

[28] https://space.uitp.org/

4.3.3 Likely societal impacts

The scientific and economic/technological impacts discussed above will also support the attainment of societal impacts as shown in Figure 18.

Figure 18: Impact pathway leading to societal impacts



Likely environmental impacts

The accelerated deployment of CCAM solutions is expected to reduce the negative environmental externalities produced by transport, in particular greenhouse gas emissions and local air pollutants, through a smoother flow of traffic and more effective use of transport infrastructure. As discussed in previous sections, there is a need to ensure that the risk of 'rebound' effects in terms of increased road traffic is mitigated against and that CCAM solutions are accompanied by synergies with decarbonisation measures and deployed in a way which facilitates inter-modality and a shift towards more environmentally friendly modes and higher vehicle occupancy. Each of the four specific objectives shown in the impact pathway diagram in Figure 18 are essential to ensuring CCAM solutions can be developed and deployed in this way.

In seeking to achieve SO5, the initiative will contribute to the creation of improved evidence of the potential socio-economic impacts of CCAM and factors influencing user/public acceptance. This, combined with more integrated development and demonstration of CCAM solutions will facilitate the strengthened links between CCAM R&I outputs and the societal policy measures which will be necessary to achieve efficiency and decarbonisation of the transport system. The accelerated deployment of CCAM solutions and their integration into the wider mobility system is anticipated to result from the achievements of the initiative with regard to SO2 and SO3 and will facilitate the realisation of positive environmental impacts, as no positive impacts of CCAM will be achieved in the absence of deployment.

Likely social impacts

The accelerated deployment of CCAM solutions which the initiative is expected to achieve has significant potential to improve road safety. Although there are still significant challenges to be addressed, particularly with regard to how automated vehicles will share streets with non-automated vehicles during an "interim period" and with vulnerable road users, but the initiative is expected to be able to contribute significantly to solving these

and other challenges through more integrated development and demonstration of solutions.

As outlined above with regard to environmental impacts, and in Section 4.3.2 with regard to potential productivity benefits, CCAM solutions (if deployed in a way which facilitates inter-modality and a shift towards more environmentally friendly modes and higher vehicle occupancy) can contribute to increasing the efficiency of the overall transport system. New shared automated mobility services can improve accessibility and social inclusion by increasing accessibility to remote areas and for individuals with reduced mobility, such as some elderly and disabled people. Shared automated mobility solutions are also expected to reduce the need for private vehicle ownership, which could disproportionately benefit lower income households. The proposed R&I initiative can achieve these impacts through the creation of an improved evidence base regarding socio-economic impacts of CCAM, strengthening links between R&I outputs and societal policy measures, and ensuring improved compatibility between the CCAM use cases developed by industry and wider societal needs.

The societal impacts of increased deployment of CCAM solutions with regard to employment are expected to be mixed. The development of new technologies and services will require new skills and highly paid jobs such as engineers and researchers, together with new medium skilled jobs to maintain the new technologies. On the other hand, demand for professional drivers is likely to gradually reduce. There will be a transition phase during which a driver is likely to still be required but would be able to perform other tasks during driving in limited conditions. A longer transition phase will increase the probability that negative implications on employment will be absorbed by the economic system, including growth in demand. Workers will need to be supported by public authorities during this labour market transition with national schemes for up-skilling and training.

4.3.4 Likely impacts on simplification and/or administrative burden

The initiative is unlikely to create impacts in terms of simplification or administrative burden of the R&I activities supported under Horizon Europe.

4.3.5 Likely impacts on fundamental rights

The increased deployment of CCAM solutions will result in a significant increase in the information shared between vehicles, infrastructure and third parties which has potential implications for individual rights with regard to privacy and the protection of their personal data. Currently, EU data protection rules (GDPR) are recognised as setting out some of the highest standards of data protection in the world. The approach taken by the Commission to date with regard to the new data which will be generated by connective and autonomous vehicles strikes a balance between fair competition, the possibility for the consumer to have access to different services, safety and cybersecurity and is in full compliance with the legislation on the protection of personal data such as user consent for data sharing. However, adequate analysis and measures will continue to be needed over the long term to safeguard sound levels of privacy and protection of personal data in the context of a likely continuing increase in requirements for access and reuse of mobility and vehicle data for both commercial and non-commercial purposes. Security and privacy topics will be an important component of the proposed R&I initiative and the integration and coordination brought about by the initiative can ensure the topics are addressed more effectively than would otherwise be the case.

While not explicitly stated within the objectives or results of the societal impact pathway, this is implicitly included in the first three specific objectives and their linked results, as well as in the elements of the first societal impact referring to ‘user-centred’ mobility and increased safety.

Open Public Consultation

In the OPC seven societal impact pathways were canvassed for relevance. The most prominent impact supported by stakeholders was "improved road safety" which is a subset of the first impact pathway in Figure 18. 89 out of 102 respondents stated it was either relevant or highly relevant with very strong alignment across all the stakeholder types. Of the 25 academic respondents 21 stated it was highly relevant, 1 stated it was relevant, and 3 didn't answer. Respondents supported actions to ensure other societal benefits were realised including traffic efficiency, more inclusive mobility and environmental externalities which supports the second impact pathway of the initiative.

Stakeholder interviews

Interviewees were supportive of the societal impact pathways objectives. In particular, all interviewees agreed that meeting societal and market needs, including accessibility of mobility and more efficient traffic flows was important (41 out of 42 rated as either medium or highly relevant, with 30 stating it was highly relevant). Furthermore 34 out of 42 stated that reducing the negative impacts, including congestion, air quality, energy consumption and climate change was highly relevant. These views were shared across the different types of stakeholders. Not listed, but raised by seven interviewees, was the importance of ensuring governance objectives were addressed within the objectives. Societal planning, to take into account user and societal needs and understand how CCAM can improve liveability, was identified as an additional objective by 4 interviewees.

4.4 Functionalities of the initiative

This section outlines the functionalities that need to be considered when assessing the policy options in Section 6, reflecting the selection criteria for European Partnerships defined in the Commission proposal for the Horizon Europe Regulation.[29] In the following paragraphs, we discuss the implications of the criteria relating to the type and composition of the actors involved, the range of activities to be undertaken and the directionality required if the initiative is to deliver the objectives discussed above. We also consider the complementarities and synergies with other, related initiatives under Horizon Europe and beyond.

4.4.1 Internal factors

Type and composition of the actors involved

This functionality relates to the criterion *"Involvement of partners and stakeholders from across the entire value chain, from different sectors, backgrounds and disciplines, including international ones when relevant and not interfering with European competitiveness".* It concerns the need to involve the full range of stakeholders that can usefully contribute to delivering the future R&I agenda.

Section 2 presents analysis of the types of actors within the current CCAM R&I value chain delivering H2020 projects, and the problems associated with their integration and coordination, and insufficient structural capacity to develop and deliver CCAM services. The types of actors required to reverse this problem, and achieve a critical mass for the development of CCAM solutions are listed in Table 44, and Figure 74 shows the estimated level of contribution they would make to the CCAM R&I action areas. A high-level summary

[29] European Commission (2018), Proposal for a Regulation of the European Parliament and of the Council establishing Horizon Europe – the Framework Programme for Research and Innovation, laying down its rules for participation and dissemination, available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018PC0435&from=EN

of the contribution these actors could bring to the specific objectives are presented in Table 5 below.

Table 5: Type and composition of actors involved

Category	Types of organisations	Key contribution to R&I agenda and objectives
Private Industry	Motor vehicle, insurance/legal, public transport operators, telecom network operators, ITS solutions	Demonstration of higher TRL integrated solutions, supporting market take-up of CCAM innovations and forming robust quality standards.
Public authorities	Member states, municipalities, road authorities, legal/regulatory/standardisation bodies	Societal needs are taken into account, supporting infrastructure is integrated, mobility is organised in the most efficient way for the city as a whole, and regulatory framework is suitable.
Research bodies	Universities, public research institutes, private research institutes	Development of lower TRL solutions and coordination of CCAM evidence base to build trust and awareness and foster integrated development and demonstrations.
Representative bodies	Road users, road safety, wider society and the environment.	Ensuring societal needs are taken into account and building trust and awareness in CCAM solutions.

The analysis shows that actors in all four "categories" have a significant part to play in achieving the objectives. In general, private industry (higher TRL) and research bodies (lower TRL) will play a key role in the advancement of the technology, whilst public authorities will facilitate demonstration activities, drive consistency and interoperability of common solutions whilst ensuring societal needs are met and suitable regulations are established. Research bodies will strengthen the evidence base for CCAM, and representative groups will inform key requirements and focus areas, ensuring specific societal needs are taken into account.

Type and range of activities

This functionality relates to the criterion "Approaches to ensure flexibility of implementation and to adjust to changing policy, societal and/or market needs, or scientific advances". It concerns the types of activity that the initiative is intended to encourage, such that it is able to respond effectively to the challenges and problems described in Section 2.

Section 1 presents the proposed CCAM platform R&I programme identified through WG1, as listed in Table 50. These activities can be grouped into three key Activity Areas: (1) Technological development, (2) Service design, demonstration and impacts and (3) R&I coordination and integration. The activities are summarised in Table 6 below.

Table 6: Activity groupings

Activity grouping	Types of activities
Technological development	These activities will focus on the technological development of CCAM systems in the areas of on-vehicle solutions (environmental perception, on board decision making, passive/active safety, vehicle validation and tele operation) and wider technological enablers (physical and digital infrastructure and connectivity). Artificial intelligence and cyber security will cut across both in-vehicle and wider enablers.
Service design, demonstration and impacts	These activities will bring together a number/all of the technologies already developed, or being developed, and test them through demonstration and/or pre-deployment activities. Results will be assessed across a broad range of impact areas including technological performance, societal need, workforce and the environment.
R&I coordination and integration	R&I coordination and integration activities supporting the two activity groups above will include the R&I agenda itself, common frameworks for testing, data exchange and storage, evaluation and overall knowledge share.

Directionality and additionality required

This functionality relates to the criteria "Common strategic vision of the purpose of the European Partnership" and "Creation of qualitative and significant quantitative leverage effects". The former highlights the importance of ensuring that all participating stakeholders have a common understanding of the purpose of the policy intervention and the direction of the R&I activity it is intended to encourage. The leverage effects relate to the creation of spillover effects of the knowledge gained in the broader community as well as the crowding-in effects on private investments in R&I – both among participating stakeholders and in the broader community, and/or the pooling of resources from EU Member States.

Mapping the key actors to the delivery of the R&I action areas in Figure 74 and the corresponding high level of overlap and integration across the actors and action areas, shows the deep level of integration and coordination that will be necessary to achieve the objectives. In particular ensuring strong feedback between the technology development activities and the service design, demonstration and impacts activities. Due to this strong feedback, and consequently an ability to be agile and adjust the technological development and/or the societal impact analysis, direction in the R&I agenda would benefit from regular review and be flexible enough to alter direction based on previous and emerging results. This fluid R&I agenda will also mean new actors will need to be introduced over the course of the initiative, and similarly some actors may reduce their involvement as requirements change.

4.4.2 External factors

The proposed Regulation for Horizon Europe also identifies the need to consider "Coordination and complementarity with Union, local, regional, national and, where relevant, international initiatives or other partnerships and missions" when assessing the case for a partnership. It concerns the potential for linkages with other relevant R&I initiatives proposed or planned for the forthcoming Framework Programme, at the EU level in the context of the MFF 2021-27, and beyond.

There are four key external factors that will support the initiative to deliver against its objectives. These are: facilitating regulations and standards, integration with deployment activities, and alignment with parallel R&I activities in other partnerships/initiatives.

Alignment with parallel R&I activities in other partnerships/initiatives

A number of existing R&I partnerships have been identified that would be complimentary to the initiative's R&I agenda. These are presented in more detail in Figure 77. There will be complimentary elements of the R&I agendas between the two initiatives that would benefit from co-working, knowledge share and even combined R&I activities. Partnerships identified as particularly relevant (they all have five links or more when aligned to the CCAM R&I agenda) are High Performance Computing, Key Digital technologies, Smart Networks and Services, and 2ZERO.

Integration with deployment activities

The initiative's objectives are quite broad, covering successful technical development, accelerated market take-up, and positive societal impacts. As deployment of CCAM solutions increases the R&I will need to be agile enough to predict, monitor and evaluate the impacts from deployment activities, and inform suitable responses which could include additional targeted R&I activities outside of the original R&I programme. This will include integration with associated CEF activities, piloting CCAM deployment.

Linkages with Member State strategies

As previously discussed, different Member States have developed with own equivalent, or sub set of, CCAM strategies to support their own R&I, deployment and industrial strategies. Linkages between the Horizon Europe initiative's R&I programme and external work undertaken within member states (in particular co-funded by the member states) will benefit from alignment and coherence. This will help address some of the fragmentation issues previously outlined.

Facilitating the ongoing development of regulations and standards

In order to support and accelerate market take-up of CCAM there needs to be strong linkage between the R&I activities and the emerging regulatory framework and its use (in particular for highly automated vehicles). Through close working, the R&I agenda can inform the regulatory framework, and vice versa, facilitating development of robust quality standards, frameworks and testing methodologies supporting interoperable solutions for CCAM, and support current and future market take-up of innovation related to CCAM.

5 What are the available policy options?

In this chapter, we provide an overview of the key characteristics of the policy options for this initiative. The Horizon Europe regulations put forward three forms of European Partnerships that constitute the policy options for this initiative; standard Horizon Europe calls are a fourth option while acting also as a baseline against which the three partnership options will be compared.

To ensure a correct assessment of the different options and their effectiveness, it is crucial to take into consideration both the objectives and the functional requirements outlined in Section 4.4. The descriptions of the options in the sections below therefore focus on the implications of the options' characteristics related to these functionalities. They are based on the options' characteristics specifically related to the functionalities listed in Section 4.4. A full description of the options is provided in the report on the overarching context to the impact assessment studies.

5.1 Option 0: Horizon Europe calls (baseline)

Table 7: Key characteristics of Option 0

	Implications of option
Enabling appropriate profile of participation (*actors involved*)	The actors are envisaged to be similar to the current CCAM platform community. The actors will have an opportunity to contribute to the strategic R&I agenda, as well as forming consortia to compete for funds on the research programme. Delivery of the actions will involve consortia of public and/or private actors in either existing established relationships, or new groupings based on the scope of the call.
Supporting implementation of R&I agenda (*activities)*	**Coordination and funding**: Undertaken centrally by EC, using the CCAM platform for key stakeholder engagement and technical coordination. Administration of CCAM platform funded by EC, stakeholder participation in platform not funded directly. Programme funded by Horizon Europe budget and co-financing rules. **Strategic R&I agenda**: EC evaluates current R&I action areas through direct project feedback, mid-term review programme, and other means. Strategic research agenda set and confirmed by EC with input from CCAM platform WG1. Definition of annual work plan owned by EC. **Delivery of R&I actions**: Consortia formed across the value chain to address the specific objectives from the calls. R&I calls are bid and delivered by the consortia. EAC assess and award the funding calls. EC monitors performance and progress of individual projects. Dissemination and joint working of R&I actions is facilitated through CCAM platform working groups 2 to 6. The projects are managed by the EC or an executive agency such as INEA.
Ensuring alignment with R&I agenda (*directionality*)	Strategic programming for CCAM R&I will be undertaken through the mainstream channels of Horizon Europe. It is assumed the existing CCAM platform will remain in place so the R&I programme will be informed by outcomes from WG1 ("Develop an EU Agenda for research, testing and pre-deployment of CCAM"), and supported through the other five working groups. The related priorities will be implemented through traditional calls under the Framework Programme covering a range of activities, but mainly calls for R&I and/or innovation actions.
Securing leveraging effects (*additionality*)	Leveraging effects will be limited to what can be achieved via Horizon Europe's funding intensity rules for different types of stakeholders. This option would have limited possibilities for co-investment by other partners (including Member States), partnerships and initiatives.

5.2 Option 1: Co-programmed European Partnership

Table 8: Key characteristics of Option 1

	Implications of option
Enabling appropriate profile of participation (*actors involved*)	A co-programmed partnership will encompass numerous organisations and associations from industry, research, NGOs etc as well as foundations and national R&I funding bodies. Within the existing CCAM platform there are about 135 different organisations represented, as shown in Figure 9. Given all stakeholders interviewed from the CCAM platform stated they would like to be part of a partnership (of any form), it is reasonable to assume the existing CCAM platform representation gives an appropriate order of magnitude when considering overall size, governance structures etc for a co-programmed partnership. Membership to the partnership can be fluid and dynamic allowing actors to join and/or leave relatively easily.
Supporting implementation of R&I agenda (*activities)*	**Coordination and funding:** The partnership could replace the entire CCAM platform, or just replace WG1. Administration of the partnership could be funded by the partners, or centrally as part of the union contribution. Partners will provide input on the drafting of the respective parts of the Annual Work programme, similar to the functioning of the existing CCAM platform WG1. These will then be proposed to the EC for implementation in the Annual Work Programme. **Strategic R&I agenda:** R&I agenda is agreed amongst the partnership and signed off by the EC annually for implementation in the Annual Work Programme. The definition of annual work plan and detailed call texts are written by the partnership and the EC. EC assess and award the funding calls through the Horizon Europe programme. **Delivery of R&I actions:** Consortia are formed across the value chain to address the specific objectives from the calls. R&I calls are bid and delivered by the consortia. The co-programmed partnership will likely monitor performance and progress of individual projects and inform updates to the strategic research programme. The projects are managed by the EC or an executive agency such as INEA.
Ensuring alignment with R&I agenda (*directionality*)	The co-programmed partnership will be based upon a Memorandum of Understanding or a Contractual Arrangement signed by the European Commission and the private and public partners. The partnership will work with the EC to agree the content of the strategic research programme. The relationship with the existing CCAM platform could take different forms. At one extreme the partnership could directly replace the functions of WG1 with the other WGs remaining, or the partnership could replace the entire platform.
Securing leveraging effects (*additionality*)	The Union contribution to the partnership is defined for the full duration and has a comparable level of certainty for the partnership over the baseline. However, there is no expectation of a legally binding commitment from other partners with regards to their contribution.

5.3 Option 2: Co-funded European Partnership

Table 9: Key characteristics of Option 2

	Implications of option
Enabling appropriate profile of participation (*actors involved*)	A co-funded partnership will encompass Member States only. Within the existing CCAM platform there are about 135 different organisations represented, and given the majority of these are not Member States there would be a significant fracturing of the existing group. It would therefore be likely that the CCAM platform would

	Implications of option
	continue as it is currently, and work closely with the co-funded partnership.
Supporting implementation of R&I agenda (*activities)*	**Coordination and funding:** The co-funded partnership would work closely with the CCAM platform, in particular WG1. Member States will provide input on the drafting of the respective parts of the Annual Work programme. These will then be proposed to the EC for implementation in the Annual Work Programme. **Strategic R&I agenda:** R&I agenda will be agreed amongst the partnership and signed off by the EC annually for implementation in the Annual Work Programme. There will be close collaboration with the CCAM WG1 R&I programme to ensure consistency. The definition of annual work plan and detailed call texts are written by the partnership and the EC. EC assess and award the funding calls through the Horizon Europe programme. **Delivery of R&I actions:** Consortia are formed across the value chain to address the specific objectives from the calls. R&I calls are bid and delivered by the consortia. The co-funded partnership will likely monitor performance and progress of individual projects and inform updates to the strategic research programme, whilst also contributing to the CCAM platform. The projects are managed by the EC or an executive agency such as INEA.
Ensuring alignment with R&I agenda (*directionality*)	The co-funded partnership will be based upon a Memorandum of Understanding or a Contractual Arrangement signed by the European Commission and the Member States. The partnership will work with the EC to agree the content of the strategic research programme.
Securing leveraging effects (*additionality*)	The Union contribution to the partnership is defined for the full duration and has a comparable level of certainty for the partnership over the baseline. However, there is no expectation of a legally binding commitment from other partners with regards to their contribution.

5.4 Option 3: Institutionalised European Partnership

5.4.1 Institutionalised Partnerships under Art. 187 TFEU

Table 10: Key characteristics of Option 3: Institutionalised Partnership Art 187

	Implications of option
Enabling appropriate profile of participation (*actors involved*)	An institutionalised partnership is likely to include the same types of actors as the co-programmed partnership. Interview evidence suggests actors would join either form of partnership and so it's not possible to confidently predict how the actors might differ between the two forms. The institutionalised partnership will create a more stable set of actors than the co-programmed partnership, with fewer new participants, and fewer partners leaving.

	Implications of option
Supporting implementation of R&I agenda (*activities)*	**Coordination:** Administration of the partnership will be funded by the partners. Partners contributions must be at least equal to 50% and may reach up to 70% of the aggregated European Partnership budgetary commitments. Commitments are legally binding and changing them will require amending legislation. **Set strategic R&I agenda:** The partnership members will have a high degree of autonomy in developing the strategic research agenda and annual work programmes and call topics, based on a transparent and accessible process, and subject to the approval of the Commission Services. The choice of topics addressed in the (open) calls are therefore strongly aligned with the needs defined. **Delivery of R&I actions:** Eligibility for participation and funding follows by default the rules of the Framework programme, unless a derogation is introduced in the basic act. The projects are managed by the partnership itself.
Ensuring alignment with R&I agenda (*directionality*)	An institutionalised partnership will bring together a stable set of partners with a strong commitment to taking a more integrated approach including the set-up of a dedicated legal entity (Union body, Joint Undertaking) that will carry full responsibility for the management of the partnership and implementation of the calls. The partnership will replace the existing CCAM platform and will set the R&I research agenda. The objectives are likely to be longer term than the co-programme partnership, going beyond a single MFF. Partners' contributions to the partnership will be legally binding, and could take the form of in-kind and/or monetary contributions. Funding for the partnership's activities could extend beyond those of Horizon Europe alone.
Securing leveraging effects (*additionality*)	While the partnership will manage its own budget in pursuit of its specific objectives, the partnership will also be able to input to wider Horizon Europe consultations and comitology processes, in order to ensure greater synergies (and possibly increased total expenditure relevant to CCAM) with other parts of Horizon Europe, whether that is other European Partnerships or missions (to be determined), science programmes (e.g. ERC) or industry competitiveness calls (e.g. Digital and Industry cluster of Pillar 2).

5.5 Options discarded at an early stage

The Co-Funded partnership is not considered relevant for the impact assessment of the candidate Institutionalised Partnership.

The co-funded option doesn't allow private industry to take part. Analysis shown in Figure 74 showing the CCAM R&I activities against the key actors shows a strong mix between private and public actors. Without private industry setting and informing the R&I agenda the initiative's objectives will not be achieved.

Discarding this option is also supported through the member state and open consultations, and also through the stakeholder interviews specific to this impact assessment.

6 Comparative assessment of the policy options

6.1 Assessment of effectiveness

Based on the intervention logic, the initiative aims to deliver scientific, economic/technological and societal (including environmental) impacts through a set of pathways (Section 4.3), which require a set of critical factors in place to be achieved in the best possible way (Section 4.4).

This section assesses the extent to which each retained policy option has the potential to allow for the attainment of the likely impacts in the scientific, economic/technological and societal sphere, based upon its characteristics (Section 5). At the end of each section we summarise the outcomes of the assessment by assigning a non-numerical score to each option for each impact desired.

The assessments in this section set the basis for the comprehensive *comparative* assessment of all retained options against all dimensions in Section 6.4.

Table 11 lists the desired impacts in the three impact areas.

Table 11: Likely impacts of the initiative

Impact area	Likely impacts
Scientific impact	Created integration of CCAM technologies in mobility systems and services.
	Strengthened European excellence in research and development of smart mobility solutions.
	Greater knowledge share and collaboration between aligned sectors and initiatives.
Economic / technological impact	Strengthened competitiveness of the transport sector.
	More appropriate and timely investment in digital and physical infrastructure to support CCAM deployment.
	Productivity benefits through more efficient mobility network and less time spent in traffic.
Societal impact	More user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation.
	Improved mitigation of negative impacts of transport on our climate and natural environment.

6.1.1 Scientific impacts

Option 0: Horizon Europe calls (baseline)

Through the CCAM platform and dedicated R&I agenda, safe and secure CCAM solutions will be developed by partners and consortia to facilitate and improve CCAM allowing communication and cooperation between vehicles, infrastructure, and other road users. The existing wide and fragmented value chain, and lack of a formal, dedicated and focussed R&I agenda that partners can align to, will make such integration of relevant research and technologies difficult and challenging to achieve. Especially when considering medium and high TRL levels which will require greater integration across technologies, and sharing between parallel projects within the initiative. Therefore, the timescale for meaningful technological development could take some time to establish, and the scientific impact of integration of CCAM technologies in mobility systems and services will only be partially achieved.

Through delivery of the CCAM platform R&I agenda, the capacity of the research community will be enhanced from the existing. However critical mass may not be achieved since the coordination between the diverse community will be loose and flexible and lack strong direction and coherence. Through the CCAM platform and supporting working groups the understanding of the current state of the art will be shared and improved. However, the lack of more formal partnership and community could result in a fragmentation of the CCAM roadmap and weaken cross sector collaborations. Therefore, the scientific impact of European excellence in research and development of smart mobility solutions will only be moderately strengthened.

Through the CCAM platform R&I agenda the evidence base for CCAM performance and impacts will be increased, in particular through impact assessments and integration with wide scale demonstration and piloting activities. However, due to difficulties in coordination of the actors the evidence base is likely to remain quite disparate across the community, reducing the chance of it being used in a systemic way and weakening added value to those in the partnership (and contributing towards it). SMEs and start-ups will have good access to the funding calls, although the overall networks will remain quite fragmented due to lack of strong coordination and direction. Therefore, knowledge exchange will continue at the same rate as existing. Cross sector collaborations, in particular with other partnerships and sectors, aren't likely to increase significantly since there will be no formal mechanism and governance to interface and coordinate. Therefore, the scientific impact of greater knowledge share and collaboration between aligned sectors and initiatives will only be partially achieved.

Option 2: Co-Funded European Partnership

Through the targeted and aligned partnership R&I agenda, safe and secure CCAM solutions will be developed by partners and consortia, in line with a clear roadmap, to facilitate and improve CCAM allowing communication and cooperation between vehicles, infrastructure, and other road users. The existing wide and fragmented value chain will be brought together more closely through a formal and focussed R&I agenda that partners can work towards. This will make the integration of relevant research and technologies easier to achieve over the baseline, and CCAM solutions for medium and high TRL levels could be achieved more rapidly. Therefore, the timescale for meaningful technological development could be accelerated over the baseline, and the scientific impact of integration of CCAM technologies in mobility systems and services will be achieved.

Through delivery of the targeted and aligned R&I agenda, the capacity of the research community will be enhanced over the existing and the baseline. Critical mass will be established over time as partners align the R&I agenda and their involvement to the ongoing needs and objectives including technological, industrial, political, social and regulatory considerations. Through the partnership and supporting working groups etc the understanding of the current state of the art will be shared and improved. The nature and means of such sharing will be aligned to the needs of the partnership and cross sector collaborations will be enhanced. Therefore, the scientific impact of European excellence in research and development of smart mobility solutions will be significantly strengthened.

Through the R&I agenda the evidence base for CCAM performance and impacts will be increased, in particular through impact assessments and integration with wide scale demonstration activities and across the value chain. The strong coordination of the evidence base will ensure the community remains aligned and joined up, allowing the evidence base to be used in a systemic way and supporting added value to those in the partnership (and contributing towards it). Therefore, knowledge exchange will continue at a greater rate as existing. SMEs and start-ups will have reasonable access to the funding calls, although could be put off by bidding unless they are part of a strong consortium with good links into the partnership, or part of an accelerator partnership. Cross sector

collaborations, in particular with other partnerships and sectors, will increase through the more formal alignment of partnership objectives and initiatives, using formal mechanisms and governance to interface and coordinate. Therefore, the scientific impact of greater knowledge share and collaboration between aligned sectors and initiatives will be achieved.

Option 3: Institutionalised Partnership

Through the strongly targeted and aligned partnership R&I agenda, safe and secure CCAM solutions will be developed by partners and consortia, in line with a clear roadmap, to facilitate and improve CCAM allowing communication and cooperation between vehicles, infrastructure, and other road users. The existing wide and fragmented value chain will be brought together more closely through a formal and focussed R&I agenda that partners can work towards. This will make the integration of relevant research and technologies easier to achieve over the baseline, and CCAM solutions for medium and high TRL levels could be achieved more rapidly. The institutionalised partnership could facilitate greater formalisation of joint working with other complimentary initiatives including regulation and standards, which could accelerate development and deployment faster than the co-programmed partnership. The scientific impact of integration of CCAM technologies in mobility systems and services will be achieved.

Through delivery of the strongly targeted and aligned R&I agenda, the capacity of the research community will be enhanced over the baseline, and potentially increased over the co-programmed initiative due to a more focussed and streamlined R&I agenda and partners. Critical mass will be established over time as partners align the R&I agenda and their involvement to the ongoing needs and objectives including technological, industrial, political, social and regulatory considerations. Through the partnership and supporting working groups etc the understanding of the current state of the art will be shared and improved. The scientific impact of European excellence in research and development of smart mobility solutions will be strengthened.

Through the R&I agenda the evidence base for CCAM performance and impacts will be increased, in particular through impact assessments and integration with wide scale demonstration activities and across the value chain. The strong coordination of the evidence base will ensure the community remains aligned and joined up, allowing the evidence base to be used in a systemic way and supporting added value to those in the partnership (and contributing towards it). Unless SMEs and start-ups are part of the partnership from its inception, they could be deterred from bidding unless they are part of a strong consortium with good links into the partnership which could result in less wide-spread and flexible knowledge share within the sector than the co-programmed partnership. Cross sector collaborations, in particular with other partnerships and sectors, will increase through the more formal alignment of partnership objectives and initiatives, using formal mechanisms and governance to interface and coordinate. Given the formal standing of the institutionalised partnership linkages with other initiatives and partnerships could be stronger than the co-programmed partnership, resulting in greater cross-sector knowledge share. Therefore, the scientific impact of greater knowledge share and collaboration between aligned sectors and initiatives will be achieved.

Open Public Consultation

Stakeholders responding to the OPC were not asked explicitly about which options would be likely to deliver the greatest scientific impacts. However, as previously noted a majority of different stakeholder groups considered the societal impacts of a partnership to be relevant or very relevant, and 58 respondents out of 87 who gave a response to the question stated that either a co-programmed or institutionalised partnership would be the preferred option.

Stakeholder interviews

Interviewees were not asked explicitly about which options would be likely to deliver the greatest scientific impacts. However, as previously noted a majority of different stakeholder groups considered the societal impacts of a partnership to be relevant or very relevant, and 32 out of 33 who gave a response to the question stated that either a co-programmed or institutionalised partnership would be the preferred option.

Summary

Table 12 below lists the scores assigned for each of the policy options, based upon the assessments above.

Table 12: Overview of the options' potential for reaching the scientific impacts

	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 3: Institutionalised
Created integration of CCAM technologies in mobility systems and services.	+	++	+++
Strengthened European excellence in research and development of smart mobility solutions.	+	+++	+++
Greater knowledge share and collaboration between aligned sectors and initiatives.	+	+++	+++

Notes: Score +++: Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential

6.1.2 Economic/technological impacts

Option 0: Horizon Europe calls (baseline)

Due to the lack of strong direction and coordination of the CCAM R&I agenda under the baseline option, the scale-up of integrated and systemic CCAM solutions that contribute to user-centric mobility services for all users is likely to restricted. Regulatory activities are likely to remain visible through the work with WG29 through CCAM platform WG4 (Road Safety) and DG GROW, although linkages with the R&I framework could be quite loose and remote. This will result in a relatively slow market take-up of CCAM solutions which would result in only moderate global visibility of demonstration, and in particular deployment, activities. This will result in the competitiveness potential of the transport sector, and systemic CCAM solutions, remaining untapped.

Under the baseline option, through the CCAM platform alone, existing gaps between the value chain (e.g. CCAM solutions and urban/regional authorities) will not significantly strengthen, and so the value chain will not be strongly integrated with only limited identification of deployment pathways. This uncertainty will result in weakened and delayed investment in digital and physical infrastructure to support CCAM deployment, especially from road authorities and supporting infrastructure providers.

The disparate value chain and less coordinated R&I agenda under the baseline will restrict the rate at which CCAM solutions can be deployed and integrated into the existing

urban/regional mobility network. This will delay the time in which productivity benefits can be realised including a more efficient road network and less time spent in traffic.

Option 1: Co-Programmed Partnership

The co-programmed partnership will provide greater direction of the R&I agenda and more coordinated value chain over the baseline, allowing the delivery and scale-up of integrated and systemic CCAM solutions that contribute to user-centric mobility services for all users. Regulatory activities are likely to remain visible through the work with WG29, although linkages with the R&I framework could be quite loose and remote, albeit stronger over the baseline option. This will result in faster market take-up of CCAM solutions over the baseline option which would result in good global visibility of demonstration, and in particular deployment, activities. The status and formality of the partnership will also help ensure a greater profile on the global stage over the baseline option. These elements will help maximise the competitiveness potential of the transport sector and marketability of systemic CCAM solutions globally.

The coordination of the value chain (e.g. linking CCAM solution development with needs of urban/regional authorities) will be strengthened under the co-programmed partnership, and so deployment pathways for both specific and more generalised use cases are likely to be greater than the baseline option. In particular this will foster greater coordination with public sector "living labs" and network facilitators. This greater certainty, understanding and trust will result in greater confidence in investment in digital and physical infrastructure to support CCAM deployment, especially from road authorities and supporting infrastructure providers.

The co-programmed partnership, with more coordinated value chain and clear R&I agenda will accelerate the rate at which CCAM solutions can be deployed and integrated into the existing urban/regional mobility network. This will bring forward the time in which productivity benefits can be realised including a more efficient road network and less time spent in traffic.

Option 3: Institutionalised Partnership

The institutionalised partnership will provide much greater focused direction of the R&I agenda and more coordinated value chain over the baseline, allowing the delivery and scale-up of integrated and systemic CCAM solutions that contribute to user-centric mobility services for all users. Regulatory activities are likely to remain visible through the work with WG29, and linkages with the R&I framework could be stronger over the baseline and co-programmed options due to higher status and formality. This will likely result in faster market take-up of CCAM solutions over the baseline and co-programmed options which would result in strong global visibility of demonstration, and in particular deployment, activities. The status and formality of the partnership will also help ensure a greater profile on the global stage over the baseline and co-programmed options. These elements will help maximise the competitiveness potential of the transport sector and marketability of systemic CCAM solutions globally.

The coordination of the value chain (e.g. linking CCAM solution development with needs of urban/regional authorities) will be strengthened under the co-programmed partnership, and so deployment pathways for both specific and more generalised use cases are likely to be greater than the baseline option. The firm commitments from both public and private sector organisations within the partnership will facilitate strong coordination with public sector "living labs" and network facilitators. This greater certainty, understanding and trust will result in greater confidence in investment in digital and physical infrastructure to support CCAM deployment, especially from road authorities and supporting infrastructure providers.

The institutionalised partnership, with more coordinated value chain and clear R&I agenda will accelerate the rate at which CCAM solutions can be deployed and integrated into the existing urban/regional mobility network. This will bring forward the time in which productivity benefits can be realised including a more efficient road network and less time spent in traffic.

Open Public Consultation

Stakeholders responding to the OPC were not asked explicitly about which options would be likely to deliver the greatest economic/technological impacts. However, as previously noted a majority of different stakeholder groups considered the economic/technological impacts of a partnership to be relevant or very relevant, and 58 respondents out of 87 who gave a response to the question stated that either a co-programmed or institutionalised partnership would be the preferred option.

Stakeholder interviews

Interviewees were not asked explicitly about which options would be likely to deliver the greatest economic/technological impacts. However, as previously noted a majority of different stakeholder groups considered the economic/technological impacts of a partnership to be relevant or very relevant, and 32 out of 33 who gave a response to the question stated that either a co-programmed or institutionalised partnership would be the preferred option.

Summary

Table 13, below, lists the scores assigned for each of the policy options, based upon the assessments above.

Table 13: Overview of the options' potential for reaching the likely economic/technological impacts

	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 3: Institutionalised
Strengthened competitiveness of the transport sector.	+	++	+++
More appropriate and timely investment in digital and physical infrastructure to support CCAM deployment.	+	++	+++
Productivity benefits through more efficient mobility network and less time spent in traffic.	+	+++	+++

Notes: Score +++ : Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential

6.1.3 Societal impacts

Option 0: Horizon Europe calls (baseline)

Under the baseline option, administering the CCAM platform R&I agenda through open funding calls, it will be unlikely that deployment will significantly accelerate, and barriers associated with integration into urban and regional mobility systems will remain

challenging. Limited deployment and the fragmented supply chain will also present challenges to significantly raise public awareness of the wider societal benefits that CCAM can bring. This will lead to difficulties in establishing user-centred, all-inclusive mobility. Furthermore safety, congestion and decarbonisation benefits brought about through CCAM solutions will take some time to be realised.

The CCAM platform R&I programme will increase the evidence base, but the relatively slow deployment rate will make it challenging to assess the impacts of at-scale CCAM solutions and limit the knowledge and understanding of real-world use cases across different geographies and mobility models. What evidence base can be established will help identify mitigation activities and emerging policy measures, but value chain gaps between key mitigation actors (policymakers and solution providers) will limit effectiveness.

Option 1: Co-Programmed Partnership

Under the co-programmed partnership, with a strong R&I agenda and coordinated value chain deployment of CCAM solutions is likely to be faster than the baseline, and barriers associated with integration into urban and regional mobility systems will gradually be addressed through coordination and collaboration between key actors. In particular between urban/regional network operators to facilitate testing, and the private sector researching and demonstrating technical solutions. Public awareness of the wider societal benefits that CCAM can bring will likely increase as greater demonstration and deployment activities will take place over the baseline. This will lead to greater delivery of user-centred, all-inclusive mobility. Furthermore safety, congestion and decarbonisation benefits brought about through CCAM solutions will be realised more quickly than the baseline option.

The co-programmed partnership, with its strong coordination activities will increase the evidence base, including evidence of deployment activities and in particular at-scale CCAM solutions and user requirements, increasing knowledge and understanding of real-world use cases across different geographies and mobility models. Any mitigation activities and emerging policy measures that will need to counter any "re-bound effects" will be identified in a pro-active way through the flexible nature of organisations involved in the partnership, and ability to easily shape the R&I agenda over the course of the partnership programme to meet changing needs and focus areas.

Option 3: Institutionalised Partnership

Under the institutionalised partnership, with a strong closely aligned R&I agenda and coordinated value chain deployment of CCAM solutions is likely to be faster than the baseline, and barriers associated with integration into urban and regional mobility systems will gradually be addressed through coordination and collaboration between key actors. In particular between urban/regional network operators to facilitate testing, and the private sector researching and demonstrating technical solutions. Public awareness of the wider societal benefits that CCAM can bring will likely increase as greater demonstration and deployment activities will take place over the baseline. This will lead to greater delivery of user-centred, all-inclusive mobility. Furthermore safety, congestion and decarbonisation benefits brought about through CCAM solutions will be realised more quickly than the baseline option. However, some concerns expressed by stakeholders over the ability of the partnership to give sufficient priority to temper technology development in favour of societal needs and corresponding policy measures to prioritise safety, congestion and decarbonisation, makes some stakeholders perceive an institutionalised partnership riskier than a co-programmed partnership. Especially with the relatively nascent and fledgling R&I value chain, only recently established through the CCAM platform initiative.

The institutionalised partnership, with its strong coordination activities will increase the evidence base, including evidence of deployment activities and in particular at-scale CCAM

solutions and user requirements, increasing knowledge and understanding of real-world use cases across different geographies and mobility models. However, any mitigation R&I activities and emerging policy measures that will need to counter any "re-bound effects" could be challenging to incorporate into an R&I agenda that is more fixed than the co-programmed partnership.

Open Public Consultation

Stakeholders responding to the OPC were not asked explicitly about which options would be likely to deliver the greatest societal impacts. However, as previously noted a majority of different stakeholder groups considered the societal impacts of a partnership to be relevant or very relevant, and 58 respondents out of 87 who gave a response to the question stated that either a co-programmed or institutionalised partnership would be the preferred option.

Stakeholder interviews

Interviewees were not asked explicitly about which options would be likely to deliver the greatest societal impacts. However, as previously noted a majority of different stakeholder groups considered the societal impacts of a partnership to be relevant or very relevant, and 32 out of 33 who gave a response to the question stated that either a co-programmed or institutionalised partnership would be the preferred option.

Summary

Table 14 lists the scores assigned for each of the policy options, based upon the assessments above.

Table 14: Overview of the options' potential for reaching the likely societal impacts

	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 3: Institutionalised
More user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation.	+	+++	++
Improved mitigation of negative impacts of transport on our climate and natural environment.	+	+++	++

Notes: Score +++ : Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential

6.2 Assessment of coherence

6.2.1 Internal coherence

In this section the extent to which the policy options show the potential of ensuring and maximising coherence with other programmes and initiatives under Horizon Europe is assessed, in particular European Partnerships.

Complimentary existing R&I partnerships have been identified and are presented in more detail in Figure 77. Partnerships identified as particularly relevant are High Performance Computing, Key Digital technologies, Smart Networks and Services, and 2ZERO. There will be complimentary elements of the R&I agendas between the pairings that would benefit from co-working, knowledge share and even combined R&I activities.

Option 0: Horizon Europe calls (baseline)

Horizon Europe calls will routinely signal the existence of other major Horizon Europe investments where there may be some value in a more or less intensive coordination, to share information and increase opportunities for synergy. The Horizon Europe application guidelines invite bidders to reflect on such issues too and the evaluation panels will also be invited to at least give some consideration to the extent to which bids have understood their position in the broader Horizon Europe portfolio and have made a good argument as to where they might (or should not) look to cooperate and coordinate with other activities.

Horizon Europe supported networks and platforms will typically have the capacity to make a good job of these synergies, both at the bid stage and during the implementation. It will be more challenging for the individual research and innovation actions, which understandably prioritise their research efforts and tend to allocate a very much smaller share of what may already be a smaller budget to the coordination and communication.

The existing situation to date hasn't facilitated strong interaction with other partnerships, and under the CCAM platform and associated R&I agenda delivery it isn't anticipated that linkages will be made significantly stronger over the existing. Any linkages that do exist will likely be more informal and loose, resulting in some untapped potential to leverage R&I learning and solutions between parallel initiatives.

Option 1: Co-Programmed Partnership

The co-programmed partnership will define its strategy in consultation with key stakeholders across the public and private sectors to ensure there is a high degree of internal coherence. Its proximity to Horizon Europe and implementation of its work programmes through Horizon Europe calls means it will align with and link to important parallel activities within the wider EU RTD Framework Programme.

There will likely be stronger internal coherence over the baseline due to the formal process for development and agreement of the R&I agenda.

Option 3: Institutionalised Partnership

The institutionalised Partnership will define its strategy in consultation with wider stakeholders to ensure there is a high degree of internal coherence with the other parts of Horizon Europe. The partnership's senior management committee and governing body will be fully appraised of the need for the programme to work in concert with other parts of Horizon Europe, and the Commission's representatives will help to ensure that this synergistic outlook works in practice.

Internal coherence will likely be stronger than the co-programmed partnership due to more targeted R&I agenda giving more integrated common purpose.

Open Public Consultation

In responding to the OPC most stakeholders (48 out of 92 that provided a response to the question) stated that the legal structure underpinning a co-programmed or institutionalised partnership was either relevant or very relevant to the facilitation of collaboration with other partnerships under Horizon Europe. Support for this view was particularly strong among academic research institutions, business associates and EU citizens.

Stakeholder interviews

Interviewees felt that a partnership for Safe and Automated Road Transport would most benefit from a relationship with bodies working towards mobility solutions and MaaS. This was followed by Zero emissions, although where interviewees specified a preferred level of involvement, it was for discussions only. The areas for which active collaboration through working together on projects, etc. was suggested were MaaS and smart cities.

6.2.2 External coherence

In this section the extent to which the policy options show the potential of ensuring and maximising coherence with EU-level programmes and initiatives beyond the Framework Programme and/or national and international programmes and initiatives is assessed.

Three key external functionalities were identified (see Section 4.4.2), i.e. integration with deployment activities, linkages with Member State strategies, and facilitating the ongoing development of regulations and standards.

Option 0: Horizon Europe calls (baseline)

Horizon Europe's work programmes are developed through a comitology process that involves several iterations of consultation with various key stakeholders, within other DGs and EU member states. Those exchanges will also involve discussions with other European and international actors in the CCAM arena, which means the CCAM calls will be framed to maximise their complementarity with initiatives in the wider landscape, including other programmes under the MFF 2021-27 (e.g. CEF).

The baseline option will be able to be flexible and reactive to coordinate and integrate with the defined externalities. However, given the CCAM platform's R&I agenda and commitments will be fairly loose, with more informal arrangements in place across a more fragmental value chain, the external coherence will be limited. For example, without a formal and committed R&I agenda Member States will find it harder to strongly support the initiative, and will be more likely to develop strategies that are less aligned to the wider EU direction.

Option 1: Co-Programmed European Partnership

Under the co-programmed partnership, the work programmes will be approved through the Horizon Europe comitology, which provides an opportunity for input by the Commission, including other DGs, and EU member states. Those exchanges will also involve discussions with other European and international actors in the CCAM arena, which means the co-programmed calls will complement initiatives in the wider landscape, including other programmes under the MFF 2021-27 (e.g. Digital Europe or the Connecting Europe Facility).

The flexible framework of the co-programmed partnership will make alignment to the R&I agenda and roadmap more attractive to Member States at the beginning of the partnership. Member States can align and adopt the strategy in their own way, under the knowledge that their approach can adjust under any changes to national policy (e.g. brought about through election results and changes in government etc).

Option 3: Institutionalised Partnership

The institutionalised partnership's strategy and work programmes will be developed with the partnership members, following wide-ranging consultation with key stakeholders, and will finally be approved by the Commission. This process includes working with other DGs and EU member states, which facilitates bi-directional information flow with the partnership's strategy also being reflected in the CCAM strategy of other EU programmes and national and regional initiatives too.

The exchanges will also involve discussions with other European and international actors in the CCAM arena, which means the partnership calls will complement initiatives in the wider landscape, with opportunities for co-funding through other programmes under the MFF 2021-27 (e.g. Digital Europe or the Connecting Europe Facility).

The more rigid and longer-term R&I agenda, and legally binding commitments, could make the active participation in the partnership less attractive to Member States causing greater fragmentation of R&I at Horizon Europe and Member State level. Unlike the co-programmed partnership where Member States can be more flexible, Member State commitments would likely be more binding and longer term, potentially resulting in lowered initial engagement and uptake.

Open Public Consultation

In responding to the OPC most stakeholders (53 out of 92 that provided a response to the question) stated that the legal structure underpinning a co-programmed or institutionalised partnership was either relevant or very relevant to the facilitation of synergies with EU or other national programmes. 58 out of 91 supported partnership's ability to facilitate harmonisation of standards and approaches, and55 out of 91 recognised the benefit of the partnership's ability to link with regulators. In general, these views were consistent across al stakeholder types.

Summary

Table 15, below, lists the scores assigned for each of the policy options, based upon the assessments above.

Table 15: Overview of the options' potential for ensuring and maximizing coherence

	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 3: Institutionalised
Internal coherence	+	++	+++
External coherence	+	+++	++

Notes: Score +++ : Option presenting a *high* potential; Score ++: Option presenting a *good* potential; Score +: Option presenting a *low* potential

6.3 Comparative assessment of efficiency

In order to compare the policy options under common standards, a standard cost model for all 13 candidate Institutionalised Partnership studies was developed. The model and the underlying assumptions and analyses are set out in the report on overarching context to the impact assessment studies. Table 16 below, shows the intensity of additional costs against specific cost items for the various options as compared to the baseline, i.e. Option 0 (Horizon Europe calls). In this table we have taken into account that for Option 3 (Institutionalised Partnership) there would be a high additional costs for the set-up of a dedicated implementation structure seeing that such a structure is not yet existing. For Option 1 (Co-programmed), we considered an additional cost for the call and project implementation as ideally, MS would be providing contributions.

Table 16: Intensity of additional costs compared with HEU Calls (for Partners, stakeholders, public and EC)

Cost items	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 3: Institutionalised
Preparation and set-up costs			
Preparation of a partnership proposal (partners and EC)	0	++	++
Set-up of a dedicated implementation structure	0	0	+++
Preparation of the SRIA / roadmap	0	++	
Ex-ante Impact Assessment for partnership	0	0	+++
Preparation of EC proposal and negotiation	0	0	+++
Running costs (Annual cycle of implementation)			
Annual Work Programme (AWP) preparation	0	+	+
Call and project implementation	0	0	+
Cost to applicants	0	0	0
Partners costs not covered by the above	0	+	+
Additional EC costs (e.g. supervision)	0	+	++
Winding down costs			
EC	0	0	+++
Partners	0	+	+

Notes: 0: no additional costs, as compared with the baseline; +: minor additional costs, as compared with the baseline; ++: high additional costs, as compared with the baseline; +++: very high additional costs, as compared with the baseline

The scores related to the costs set out above will allow for a "value for money" analysis (cost-effectiveness) in the final scorecard analysis in Section 6.4. For this purpose, in Table 17 where scores for the scorecard analysis, based on insights and findings and based on the scores above, a score of 1 is assigned to the option with the highest costs and a score 3 to the lowest.

Table 17: Matrix on 'overall costs' and 'cost-efficiency'

	Option 0: Horizon Europe calls	Option 1: Co-programmed	Option 3: Institutionalised
Overall cost	3	2	1
Cost-efficiency	3	3	2

Notes: Score 1 = Substantial additional costs, as compared with the baseline; score 2 = Medium additional costs, as compared with the baseline; score 3 = No or minor additional costs, as compared with the baseline

While there is a clear gradation in the overall costs of the policy options, the cost differentials are less marked when the financial leverage (co-financing rates) are taken into account and the total budget available for each of the policy options, assuming a common Union contribution. From this perspective, there are only one or two percentage points that split the most cost-efficient policy options – the baseline Option 0 and the Co-Programmed policy options – and the least cost-efficient – the Institutionalised Partnership options. Therefore, a score of 3 is assigned to Option 0 and the Co-Programmed policy options for cost-efficiency and a score of 2 for the Institutionalised Partnership policy options.

It should be noted that the potential for the creation of crowding-in effects for industry has been taken into account when assessing the effectiveness of the policy options, above.

6.4 Comprehensive comparison of the options and identification of the preferred option

Building upon the outcomes of the previous sections, this section presents a comparison of the options' 'performance' against the three dimensions of effectiveness, efficiency and coherence.

In Section 6.4.1, the policy options against each other for each criterion in the effectiveness and coherence dimensions are compared, resulting in a scorecard with scores from 1 to 3 where 3 stands for a substantially higher performance. Combined with the results from the comparative assessment for efficiency in Section 6.3, above, the final scorecard allows for the identification of the preferred option in Section 6.4.2, taking all dimensions and criteria into account.

6.4.1 Comparative assessment

The following sub-sections explain the scores assigned to each policy option on each criterion, as summarised in Table 18.

Effectiveness

Scientific impacts

Under the baseline option, the existing wide and fragmented value chain, and lack of a formal, dedicated and focussed R&I agenda that partners can align to, will make integration of relevant CCAM research and technologies difficult and challenging to achieve. The co-programmed and institutionalised partnerships will provide greater integration and direction, allowing more strengthened European excellence, and greater knowledge share and collaboration between aligned sectors and initiatives. The institutionalised partnership is likely to deliver greater integration of CCAM technologies into mobility systems and services over the co-programmed partnership, due to a more targeted R&I agenda with a higher proportion of higher TRL projects and streamlined R&I focussed on a deployment roadmap.

Economic and technological impacts

Due to the lack of strong direction and coordination of the CCAM R&I agenda under the baseline option, the scale-up integrated and systemic CCAM solutions that contribute to user-centric mobility services for all users is likely to restricted. This will result in a relatively slow market take-up of CCAM solutions which would result in only moderate global visibility of demonstration, and in particular deployment, activities. This will result in the competitiveness potential of the transport sector, and systemic CCAM solutions, remaining untapped. Under the two partnership options there is likely to be an acceleration and scale-up of CCAM solutions over the baseline, due to a more targeted and coordinated R&I agenda and value chain. The institutionalise partnership, with its longer term and more focussed R&I agenda on key deployment pathways, is likely to lead to greater competitiveness of the industry over the co-programmed partnership.

Societal impacts

Under the baseline option, administering the CCAM platform R&I agenda through open funding calls, it will be unlikely that deployment will significantly accelerate, and barriers associated with integration into urban and regional mobility systems will remain challenging. Limited deployment and the fragmented supply chain will also present challenges to significantly raise public awareness of the wider societal benefits that CCAM can bring. This will lead to difficulties in establishing user-centred, all-inclusive mobility and realising its benefits. In particular safety, congestion and decarbonisation benefits brought about through CCAM solutions will take some time to be realised. Under the two partnership arrangements the development of CCAM solutions is likely to be faster than the baseline, allowing the associated societal benefits to be realised sooner. However, the restrictions under the institutionalised partnership including lack of R&I and partner flexibility to adapt to emerging needs (including those of Member States) leads to a chance of lower societal benefits and impacts over the co-programmed partnership.

Coherence

The formal nature and associated focus of the two partnership options will provide greater internal and external coherence over the baseline. The institutionsied partnership could provide greater internal coherence due to stronger and more aligned linkages with other complimentary Horizon Europe partenrships. External coherence is likely to be strong under the co-prorgammed partenrship, principally through the higher chance of more integrated and aligned participation from Member States, and their national policies, strategies and investments.

Table 18: Scorecard of the policy options

	Criteria	Option 0	Option 1	Option 3
Effectiveness	**Scientific impacts**			
	Created integration of CCAM technologies in mobility systems and services.	1	2	3
	Strengthened European excellence in research and development of smart mobility solutions.	1	3	3
	Greater knowledge share and collaboration between aligned sectors and initiatives.	1	3	3
	Economic/technological impacts			
	Strengthened competitiveness of the transport sector.	1	2	3
	More appropriate and timely investment in digital and physical infrastructure to support CCAM deployment.	1	2	3
	Productivity benefits through more efficient mobility network and less time spent in traffic.	1	3	3
	Societal impacts			
	More user-centred, all-inclusive mobility, while also increasing safety, reducing congestion and contributing to decarbonisation.	1	3	2
	Improved mitigation of negative impacts of transport on our climate and natural environment.	1	3	2

	Criteria	Option 0	Option 1	Option 3
Coherence	**Internal coherence**	1	2	3
	External coherence	1	3	2
Efficiency	**Overall cost**	3	2	1
	Cost-efficiency	3	3	2

Notes: Scores for effectiveness and coherence: 3 = *substantially higher performance*; 2 = *higher performance*; 1 = *lower performance*. Scores for efficiency: 1 = *substantial additional costs*, as compared with the baseline; 2 = *medium additional costs*, as compared with the baseline; 3 = *No or minor additional costs*, as compared with the baseline

6.4.2 Identification of the preferred option

The baseline option (i.e. open calls) scores worse against both types of partnership across all impact areas and coherence categories. It is therefore not considered suitable to be taken forward as an option for Horizon Europe.

Despite the benefits the institutionalised partnership provides over the co-programmed partnership in the scientific and economic/technological areas, the societal benefits (where the institutionalised partnership scores worse than the co-programmed) is a major aspect to consider. There is concern amongst the majority of stakeholders that the institutionalised partnership could lead to a closed group of key partners and leave little room for flexibility in terms of organic and evolving membership, adaptive R&I agenda, and innovative research. These aspects will be needed whilst the technology is developing rapidly, and wider societal impacts need to be monitored, understood, and planned for.

Therefore, it is deemed most appropriate to **recommend the co-programmed partnership as the preferred option**. The co-programmed partnership will provide significant improvements on directionality over the baseline, whilst allowing for flexibility of approach over time which the institutionalised partnership cannot guarantee.

However, given the institutionalised partnership scores higher than the co-programmed partnership in other areas (in particular scientific and economic/technological impact pathways), the benefits of an institutionalised partnership should be regularly assessed whilst the partnership is maturing, and at a time when the societal impacts are better understood, and greater alignment of objectives across the value chain is achieved, then the partnership could be stable enough for a more significant joint undertaking.

7 The preferred option

7.1 Description of the preferred option

A CCAM co-programmed partnership will provide the platform for the European CCAM community to design and implement a strategic research and innovation agenda that directly addresses each of the specific objectives listed in Section 4.

The CCAM partnership strategy will be led by the partners in conjunction with EU member states (a public-private partnership) and will be developed in consultation with stakeholders from across the diverse CCAM value chain across Europe. It will encompass the views of the CCAM industry, public sector, the research community and representative bodies.

In Table 19, below, the alignment of the preferred option with the selection criteria for European Partnerships defined in Annex III of the Horizon Europe Regulation is provided. Seeing that the design process of the candidate co-programmed partnership is not yet concluded and several of the related topics are still under discussion at the time of writing, the criteria of additionality/directionality and long-term commitment are covered in terms of expectations rather than ex-ante demonstration.

Table 19: Alignment with the selection criteria for European Partnerships

Criterion	Alignment of the preferred option
Higher level of effectiveness	The co-programmed partnership will bring the value chain together in a coordinated and focussed manner. Through a joint strategic research agenda, with agreement from all actors including private, public, research and representative bodies the full value chain can be aligned to a single overall vision, objectives, R&I agenda and roadmap. This will result in more focussed R&I activities in key areas that help target and accelerate the development of CCAM solutions, and ultimately lead to faster deployment and benefits realisation. The dynamic nature of the CCAM R&I area both in terms of research activities and key contributors will be well suited to the co-programmed partnership, allowing both partnership membership and R&I strategy to react and respond to the emerging solutions, impacts and consequences.
Coherence and synergies	The partnership objectives would be coherent with the Horizon Europe objective. Including strengthening the scientific and technological bases of the Union and fostering its competitiveness in all Member States including in its industry. The partnership would align well with the strategic value chain for "Connected, clean and autonomous vehicles". The partnership also aligns well with the SDGs including decent work and economic growth, industry innovation and infrastructure, sustainable cities and communities, climate action, and partnerships for the goals.
Transparency and openness	The partnership will allow organisations to join and leave the partnership over the course of the programme, and their contribution to the identification of priorities and objectives will remain transparent and open. Furthermore, organisations will not be restricted to being a partner to be eligible to apply for funding through the Horizon Europe calls, albeit participation within the partnership will likely provide in terms of forward visibility, knowledge share, and relationships.
Additionality and directionality	The co-programmed partnership will define its R&I strategy and roadmap in consultation with key stakeholders across the public, private and research sectors. This will provide strong directionality for the partnership. Its proximity to Horizon Europe and implementation of its work programmes through Horizon Europe calls means it will align with and link to important parallel activities within the wider EU RTD Framework Programme. The flexible framework of the co-programmed partnership will make alignment to the R&I agenda and roadmap more attractive to Member States at the beginning of the partnership. Member States can align and adopt the strategy in their own way, supporting additionality effects across Europe
Long-term commitment	The expectation is that a minimum share of public and/or private investments will be made.

7.2 Objectives and corresponding monitoring indicators

Figure 19 below lists a broad range of actions and activities, beyond the R&I activities that can be implemented under Horizon Europe. This reflects the definition of European Partnerships in the Horizon Europe regulation as initiatives where the Union and its partners "commit to jointly support the development and implementation of a programme

of research and innovation activities, including those related to market, regulatory or policy uptake."

The three internal activities (shown in light blue) match the activity groupings set out in Table 6. The first three external activities (shown in grey) match the three external factors described in Section 4.4.2, i.e. alignment to standards/regulatory work, deployment activities and coordination between parallel partnerships.

7.2.1 Operational objectives

Figure 19, overleaf, lists a range of actions and activities, going also beyond the R&I activities that can be implemented under Horizon Europe (highlighted in yellow). This reflects the definition of European Partnerships in the Horizon Europe regulation as initiatives where the Union and its partners "commit to jointly support the development and implementation of a programme of research and innovation activities, including those related to market, regulatory or policy uptake."

7.2.2 Monitoring indicators

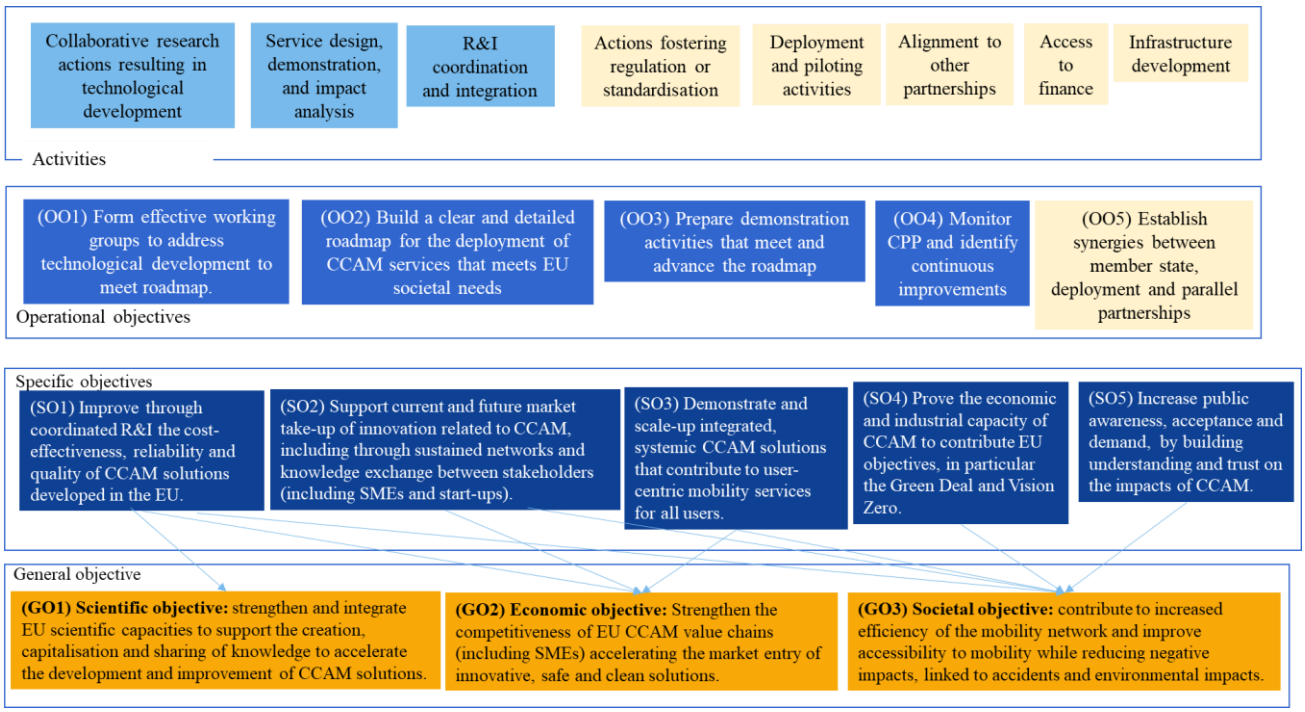
Table 20 gives some key monitoring indicators for tracking progress of the initiative towards its targeted impacts in addition to the ones identified for the wider Horizon Europe key impact pathways. Short-term outputs relate to the operational objectives, medium-term to the specific objectives, and long-term to the general objectives.

Table 20: Monitoring indicators in addition to Horizon Europe key impact pathway indicators

	Short-term (typically as of year 1+)	**Medium-term (typically as of year 3+)**	**Long-term (typically as of year 5+)**
Scientific impact	Number of working groups and ToR established and signed showing alignment to wider roadmap. Value of R&I actions Peer reviewed scientific publications in CCAM.	Common integrated and central evidence base of CCAM R&I including results from demonstration activities and wider initiatives. Number of times that publications generated by the partnership are cited in the global literature	Ensure critical mass in Europe for the development of CCAM solutions to improve the safety of road traffic Number of patents and industrial designs registered by suppliers of CCAM equipment and systems based in Europe
Technological / economic impact	CCAM roadmap complete and agreed, showing linkages to other initiatives. Number of programmed projects involving SMEs and/or organisations outside the automotive industry	Number, scale and impacts of successful demonstration activities proving the benefits of CCAM in use cases supporting high levels of automation. Number of projects demonstrating Day 1.5 services	Extended industrial leadership in CCAM. Number of projects demonstrating Day 1.5+ services.
Societal impact including environmental / sustainability	Number of researchers/individuals trained through the initiative.	Demonstration of societal benefits with attributable linkages to CCAM including road safety,	

	Short-term (typically as of year 1+)	Medium-term (typically as of year 3+)	Long-term (typically as of year 5+)
	Portfolio of demonstration activities identified including research questions and alignment roadmap	environment and wider societal needs.	

Figure 19: Operational objectives of the initiative



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Appendix B Synopsis report on the stakeholder consultation – Focus on the candidate European Partnership on Safe and Automated Transport

Disclaimer: the views expressed in the contributions received are those of the respondents and cannot under any circumstances be regarded as the official position of the Commission or its services.

B.1 Introduction

Following the European Commission's proposal for Horizon Europe in June 2018,[30] 12 candidates for institutionalised partnerships within 8 partnership areas have been proposed, based on the political agreement with the European Parliament and Council on Horizon Europe reached in April 2019.[31] Whether these proposed institutionalised partnerships will go ahead in this form under the next research and innovation programme is subject to an impact assessment.

In line with the Better Regulation Guidelines,[32] the stakeholders were widely consulted as part of the impact assessment process, including national authorities, the EU research community, industry, EU institutions and bodies, and others. These inputs were collected through different channels:

- A feedback phase on the inception impact assessments of the candidate initiatives in August 2019,[33] gathering 350 replies for all 12 initiatives;
- A structured consultation of Member States performed by the EC services over 2019;
- An online public stakeholder consultation administered by the EC, based on a structured questionnaire, open between September and November 2019, gathering 1635 replies for all 12 initiatives;
- A total of 608 Interviews performed as part of the thematic studies by the different study teams between August 2019 and January 2020.

This document is the synopsis report for the initiative "Safe and Automated Road Transport". It provides an overview of the responses to the different consultation activities. A full analysis of the results is provided in the study Data Report.

[30] https://ec.europa.eu/commission/presscorner/detail/en/IP_18_4041

[31] https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_19_2163

[32] https://ec.europa.eu/info/files/better-regulation-guidelines-stakeholder-consultation_en

[33] The full list of inception impact assessments is available here. They were open for public feedback until 27 August 2019.

B.2 Feedback to the inception impact assessment on candidate initiatives for institutionalised partnerships

Following the publication of the inception impact assessment, a feedback phase of 3 weeks allowed any citizen to provide feedback on the proposed initiatives on the "Have your say" web portal. In total 350 feedbacks were collected for all initiatives.

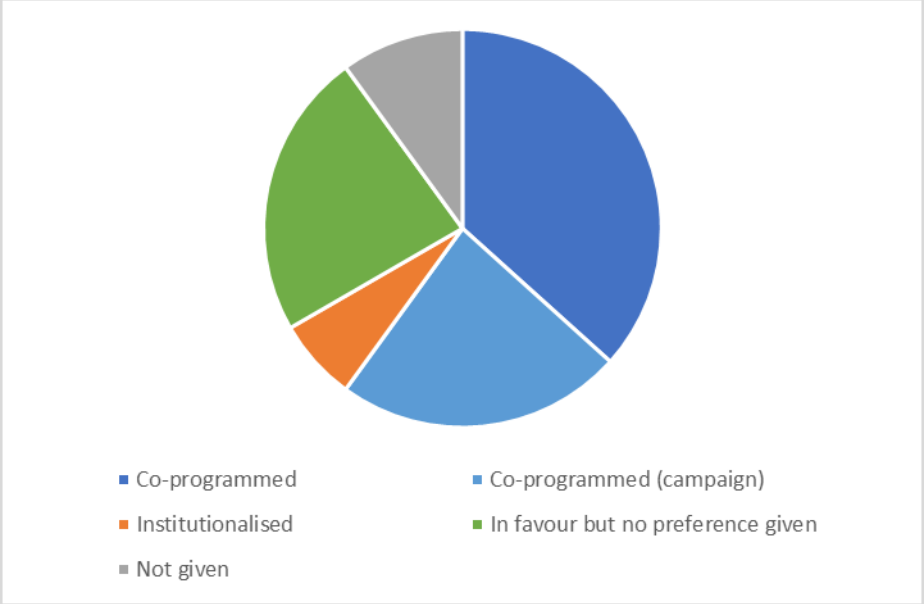
For the initiative "Safe and Automated Road Transport" 30 individual feedbacks were collected, mainly from company/business organisations.[34] Among the elements mentioned were:

- 13 stakeholders formally recognised the potential benefits of CCAM technology, including safety, network efficiency, decarbonisation and regional productivity.
- 14 stated the need for a partnership to bring together the fragmented supply chain and work together in a collaborative and cooperative way. In particular recognising the need to bring industry, academia and public sector together to research and develop technology, and test/trial/demonstrate solutions in public areas to understand societal needs and impacts.
- 11 respondents recognised the need for the research agenda to take into account all relevant stakeholders, not just one particular influential group.
- 10 stakeholders identified the need for the research agenda to help accelerate deployment of advanced CCAM technologies and services.
- 6 out of 30 respondents stressed the importance of close collaboration with other partnerships, including ECSEL, 5G, Cyber security, HPC and AI.

27 out of 30 were all in favour of a partnership, with most in favour of a co-programmed partnership. The main reasons for preferring a co-programmed partnership were the perceived benefits in speed, flexibility, openness and lower administrative burden. Reasons for an institutionalised partnership included security of investment and targeted/specific R&I agenda. The distribution of answers in support of each type of partnership were as follows.

[34] Feedback on inception impact assessment to be found on https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2019-4980228/feedback_en?p_id=5722781

Figure 20: Preference of partnership type according to Inception Impact Assessment Feedback



B.3 Structured consultation of the member states on European partnerships

A structured consultation of Member States through the Shadow Strategic Configuration of the Programme Committee Horizon Europe in May/ June 2019 provided early input into the preparatory work for the candidate initiatives (in line with the Article 4a of the Specific Programme of Horizon Europe). This resulted in 44 possible candidates for European Partnerships identified as part of the first draft Orientations Document towards the Strategic Plan for Horizon Europe (2021-2024), taking into account the areas for possible institutionalised partnerships defined in the Regulation.

The feedback provided by 30 countries (all Member States, Iceland and Norway) has been analysed and summarised in a report, with critical issues being discussed at the Shadow Strategic Programme Committee meetings.

B.3.1 Key messages overall for all candidate Institutionalised Partnerships are the following:

Overall positive feedback on the proposed portfolio, but thematic coverage could be improved

The results indicate a high level of satisfaction with the overall portfolio, the level of rationalisation achieved, and policy relevance. While delegations are in general satisfied with the thematic coverage, the feedback suggests the coverage could be improved in cluster 2 "Culture, creativity and inclusive society" and cluster 3 "Civil Security for Society".

Large number (25) of additional priorities proposed for partnerships by delegations

Despite high satisfaction with the portfolio and candidates put forward by the Commission, countries put forward a high number of additional priorities to be considered as European Partnerships. A closer examination suggests that these additional proposals are motivated by very different reasons. Whilst some proposals are indeed trying to address gaps in the portfolio and reach a critical mass, then, others are driven by the wish to maintain existing networks, currently not reflected in the Commission proposal (e.g. those based on JPIs, ERA-NETs). In addition, some proposals reflect worries over some topics not being sufficiently covered in the existing proposals, but could be possibly well covered within the scope of existing partnerships, or by traditional calls under the Framework Programme.

Critical view on the high number and openness of Joint Undertakings

Country feedback suggests dissatisfaction with the high number of proposed Article 187 TFEU partnerships. Notably smaller as well as EU-13 countries raise concerns with regards to the potential insufficient transparency and openness of the partnership model. In the feedback, countries either directly support or ask to carefully analyse whether the objectives of this proposal could be reached with the co-programmed model.

For those partnerships that will be set up on the basis of Article 187, the country feedback stresses the need to ensure a clear shift towards openness in the governance, membership policy and allocation of funding of these partnerships. Notably, it is emphasised that the JU rules should not have any limitations or entry barriers to the participation of SMEs and other partners, including from academia.

Although the feedback suggests a general criticism, there are few concrete and broadly supported proposals, including to reduce the number of institutionalised partnerships mergers or by alternative implementation modes.

Lack of cross-modal perspective and systematic approach to mobility

The current proposal foresees 5 partnerships in the area of transport (for rail, air traffic management, aviation, connected and automated driving, zero-emission road transport), and 2 that in closely related technologies for radically reducing carbon emissions (hydrogen, batteries). Several delegations would wish to see a systemic approach to developing mobility and addressing related challenges (optimisation of overall traffic, sustainable mobility solutions for urbanisation), and do not support a mode-dependent view only. This suggests the need to discuss how to ensure greater cooperation between transport modes and cross-modal approaches in establishing partnerships in the area of mobility.

Partnership composition: the role of Member States in industry partnerships

The composition and types of partners is an important element for the success of a partnership, e.g. to ensure the right expertise and take-up of results. Ensuring broad involvement without overly complicating the governance of the partnership remains an important an important challenge in the design of future partnerships.

In the feedback, several Member States express their interest to join as a partner in partnerships that have traditionally been industry-led. However, individual comments suggest there are different views on what their involvement means in practice, with some countries expressing readiness to commit funding, while others support limiting their involvement to alignment of policies and exploiting synergies. This suggests the need to discuss further what the involvement of Member States means in practice (notably in terms of contributions, in the governance), and what would be possible scenarios/options in Horizon Europe. There is special interest in testing and deployment activities, in synergies with Cohesion Funds and CEF priorities and investments.

Although it is too early to determine the interest of industry/ businesses in the topics proposed for partnerships where the main partners are public authorities, their involvement in in public centric partnerships will also be an important question in the design and preparation of future proposals.

Some proposals are more mature than others

The analysis of feedback per partnership candidates suggests that some proposals are more mature, while others would need more time to determine the scope, objectives, partner composition and contribution and appropriate mode of implementation. This relates to in particular to partnerships with no predecessors and those where the main partners are public. It suggests that the proposals would need to be developed at different paces in

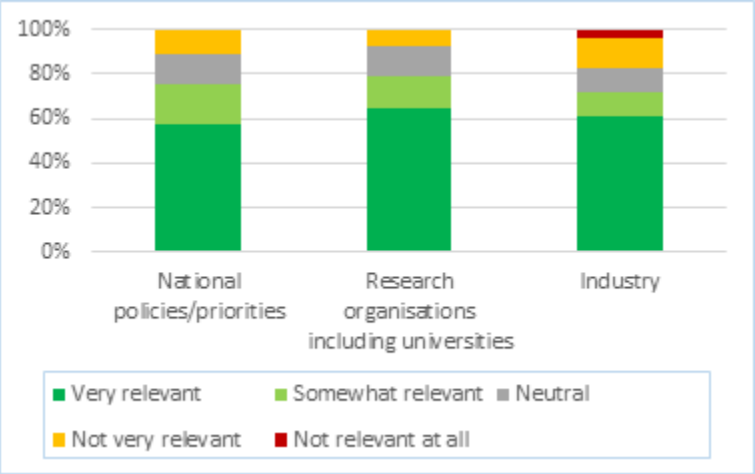
order to achieve good quality, and thus, not all partnership proposals may be ready for implementation at the start of Horizon Europe. For the initiative "Safe and Automated Road Transport" the following overall feedback was received from Member States.

B.3.2 Overall feedback for the initiative "Safe and Automated Road Transport"

Relevance and positioning in a national context

Overall the results of the consultation confirm the relevance of the proposed European Partnership on Mobility and Safety through Automated Road Transport, with 78% considering it considering it very or somewhat relevant for their research organisations, including universities, 75% for their national policies and priorities, and 72% respondents found the proposed partnership as relevant for their industry.

Figure 21: Relevance of the European Partnership on Mobility and Safety through Automated Road Transport in the national context



On the question of existing national/regional R&I strategies, plans and/ or programmes in support of the proposed Partnership on Mobility and Safety through Automated Road Transport, 23 countries report to have relevant elements in place. National R&I strategies or plans were identified most frequently (68 %, AT, CZ, DE, EE, FR, HR, HU, IE, IT, LUX, LV, NL, RO, SE, SI, SK, UK, IS, NO), followed by national economic, sectoral strategy and/or plan with a strong emphasis on R&I (57%, AT, CZ, DE, EE, FR, HR, HU, IE, LU, LV, NL, RO, SE, SK, UK, NO), regional R&I and/or smart specialisation strategies (54 %, AT, BE, CZ, FR, HR, HU, IT, LUX, NL, PL, RO, SE, SI, SK, UK), dedicated R&I funding programmes or instruments (50 %, AT, CZ, DE, EE, FR, HR, HU, LUX, NL, PL, SE, SK, UK, NO). 11 countries (AT, CZ, EL, ES, FR, HR, HU, IE, LUX, RO, SE) report other policies/ programmes, such as upcoming sectoral agenda, e.g. dedicated national public-private partnerships/ cluster in the area of autonomous vehicles, test tracks/beds, and broader national strategies (not R&I focused).

Delegations identified a number of aspects that could be reinforced in the proposal for this partnership that would increase its relevance for national priorities, e.g.[25]:

- Cover all modes of transport (including e.g. maritime and waterborne transport);
- Stronger emphasises on research and innovation (encompassing also research-oriented recommendations from STRIA Roadmap on Connected & Automated Transport);
- Increased focus on road safety and its validation;
- Include infrastructure aspects (digital and physical);
- Include cross-cutting issues, such as digitalisation, AI and ethics, smart mobility and cities, standardisation;

- Ensure synergies and alignment with related initiatives (e.g. 5G, CAM, AI, HPC) and EU funding programmes (e.g. CEF);
- Increased focus on transitional aspects, notably optimisation of the overall traffic;
- Adopt a regional/ place-based approach to facilitate developing, testing and validating real existing solutions/services and on business models in use-case oriented smaller platforms.

Half of the countries (50%) are undecided concerning their interest to participate. At this stage 11 countries (BE, CZ, EE, ES, HU, IE, IT, LUX, MT, PT, SK) express interest to join as a partner, and 3 countries (CY, DE, IS) express there is no national interest to participate. Governmental research organisations (50%), regional R&I and /or smart specialisation strategies (39%) and existing national R&I programmes (39%) and research infrastructures (36%) are identified as potential partners or contributors most frequently. In additional comments, some countries specify the nature of their possible contributions, while others stress they need for more information to allow meaningful analysis of their participation.

While many are undecided concerning their participation, almost all countries (93%) express interest in having access to results produced in the context of the partnership.

Feedback on objectives and impacts

Overall there is a good agreement (50% consider very relevant and 25% relevant) on the use of partnership approach in addressing mobility and safety through Automated Road Transport. 61% of countries think that the partnership is more effective in achieving the objectives and delivering clear impacts for the EU and its citizens, but to a much lesser degree (33%) that it would contribute to improving the coherence and synergies within the EU R&I landscape.

The feedback from countries indicate good agreement with the proposed objectives at short, medium and long term (75%) and the expected scientific, economic and societal impacts at European level (82%). 79% of countries consider the impacts very or somewhat relevant in the national context. There is overall agreement with the envisaged duration of the proposed partnership with 71% of countries finding it adequate. In additional comments, some delegations are supportive of the proposed objectives, while others call for a change in focus, notably by ensuring a more holistic view of the transport system and its future technological, systemic and investment policy requirements, as well as increasing focus on user behaviour and user acceptance. Two countries express dissatisfaction with apparent overlaps with the proposed partnership "Towards zero-emission road transport" and ask to consider a merger. Other comments ask to clarify the relation with the C-ITS platform and CCAM Single Platform for road testing & pre-deployment.

Views on partners, contributions and implementation

A little over half (54%) of the countries agree on the type and composition of partners, whilst 18% remain neutral and 14% disagree. In additional comments, many delegations emphasise the need to involve Member States, notably national, and where relevant, regional road safety and vehicle reception authorities. Several countries also underline the need to ensure open membership policy, as well as active involvement of small players (including SMEs). Other comments highlight the need to involve academia and research organisations, as well as telecommunication sector among partners and stakeholders. At this stage most countries (79%) would need more information on contributions and level of commitments expected from partners. Majority of the countries (79%) found that there was insufficient information to assess the nature of contributions and level of commitment from the partners.

Half of the countries found that there was insufficient information to assess the proposed mode of implementation in the form of Article 187 TFEU, while 7 countries oppose this and 4 are in favour. Those opposing the proposed implementation form indicate the need to consider co-programmed as an alternative implementation to provide flexibility in a rapidly changing area and openness to include all relevant stakeholders. In additional comments, there are two countries who express being against a partnership at this stage – one country indicates a preference to implement the topic through regular calls under the Horizon Europe Work Programmes, and the other suggests too much uncertainty regarding implementation at this stage to form a partnership

B.4 Targeted consultation of stakeholders related to the initiative "Safe and Automated Road Transport"

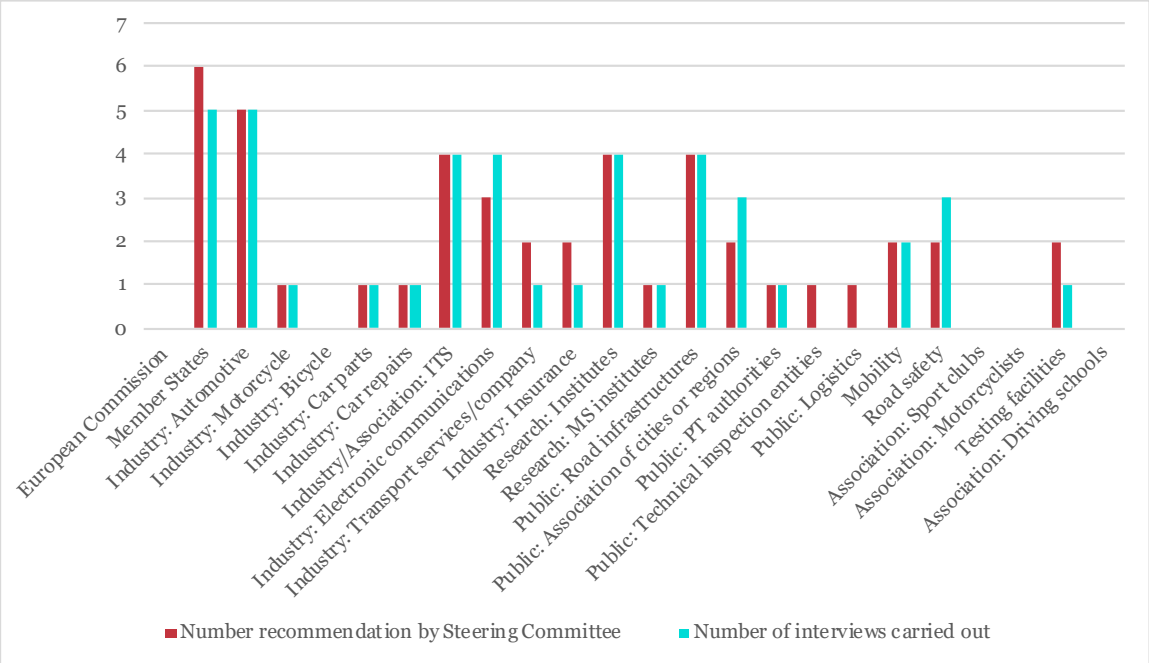
In addition to the consultation exercises coordinated by EC services, the external study thematic teams performed targeted consultations with businesses, research organisations and other partners on different aspects of potential European Partnerships. Approach to the targeted consultation.

The objective of the interviews was to gather the views of key stakeholders in the field to feed into the problems, problem barriers, objectives, need for EU action and functionalities sections of the impact assessment study.

Interviewees were identified through the Cooperative, Connected and Automated Mobility (CCAM) Single Platform. The group consists of 42 members – 28 Member State authorities, and 14 organisations (associations) selected via online calls for applications[35].

These contacts were emailed individually with a request for an interview along with a briefing document containing background information, the questionnaire and a letter of support from the Commission. Interviews with a duration of one to two hours were arranged with those that responded and a reserve list was used to account for some that did not respond. The target number of interviews, and those achieved, are shown in Figure 22.

Figure 22: Number of interviews per stakeholder type identified as part of the CCAM platform



[35] https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3657

The distributed questionnaire consisted of 38 questions divided into 7 sections, each of which related to one of the six lists provided as part of the briefing document: problems/barriers, opportunities, objectives, R&I actions, types of partnership and types of member.

The number of representatives from the stakeholder categories, along with the proportion of total interviewees they make up (% share) is shown in Table 21 Research institutes were most highly represented, followed by member states and the automotive industry. Following these, ITS and electronics industry representatives and associations for road infrastructure were equally represented with 4 interviewees in each category.

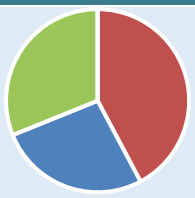
Table 21: Number of interviews per stakeholder category

	Category	No.	% Share	Group
1	European Commission			
2	Member States	5	11.1	PUB
3	Industry: Automotive (includes manufacturers and associations of manufacturers of vehicles including cars, trucks, buses)	5	11.1	PRC
4	Industry: Motorcycle (includes manufacturers and associations of manufacturers)	1	2.2	PRC
5	Industry: Bicycle (manufacturers)			
6	Industry: Car parts (manufacturers)	1	2.2	PRC
7	Industry: Tyres (includes manufacturers and associations of manufacturers)	1	2.2	PRC
8	Industry: Car repair services	1	2.2	PRC
9	Industry: ITS (includes providers, associations of providers, consultancy, solution providers (including automation), and others)	4	8.9	PRC
10	Industry: Electronic (includes association of automotive and electronic communications companies/groups, association of automotive and electronic communications companies/groups, electronic communications)	4	8.9	PRC
11	Industry: Transport Services (includes transport services company/groups, association of road transport operators)	1	2.2	PRC
12	Industry: Insurance (includes companies and associations of companies/groups)	1	2.2	PRC
13	Research: Institutes (includes individual institutes and associations of institutes)	6	13.3	REC
14	Research: EC (includes associations, MS and research institutes, R&I clusters)	1	2.2	REC
15	Association: Road infrastructure (includes managers/operators, associations of managers/operators, ITS solution providers)	4	8.9	PUB
16	Association: Cities (and/or regions)	3	6.7	PUB

Category		No.	% Share	Group
17	Public: Public transport (includes public transport authorities and operators and individual experts)	1	2.2	PUB
18	Public: Technical inspection (includes association of technical Inspection entities)			
19	Public: logistics			
20	Mobility (includes mobility solutions and smart mobility and advisory)	2	4.4	REC
21	Association: Road safety	3	6.7	REC
22	Association: Sports clubs (motoring and motor sports)			
23	Association: Motorcyclists			
24	Testing (includes providers of testing facilities, services and analysis)	1	2.2	PUB
25	Association: Driving schools			
Total		**45**	**100%**	

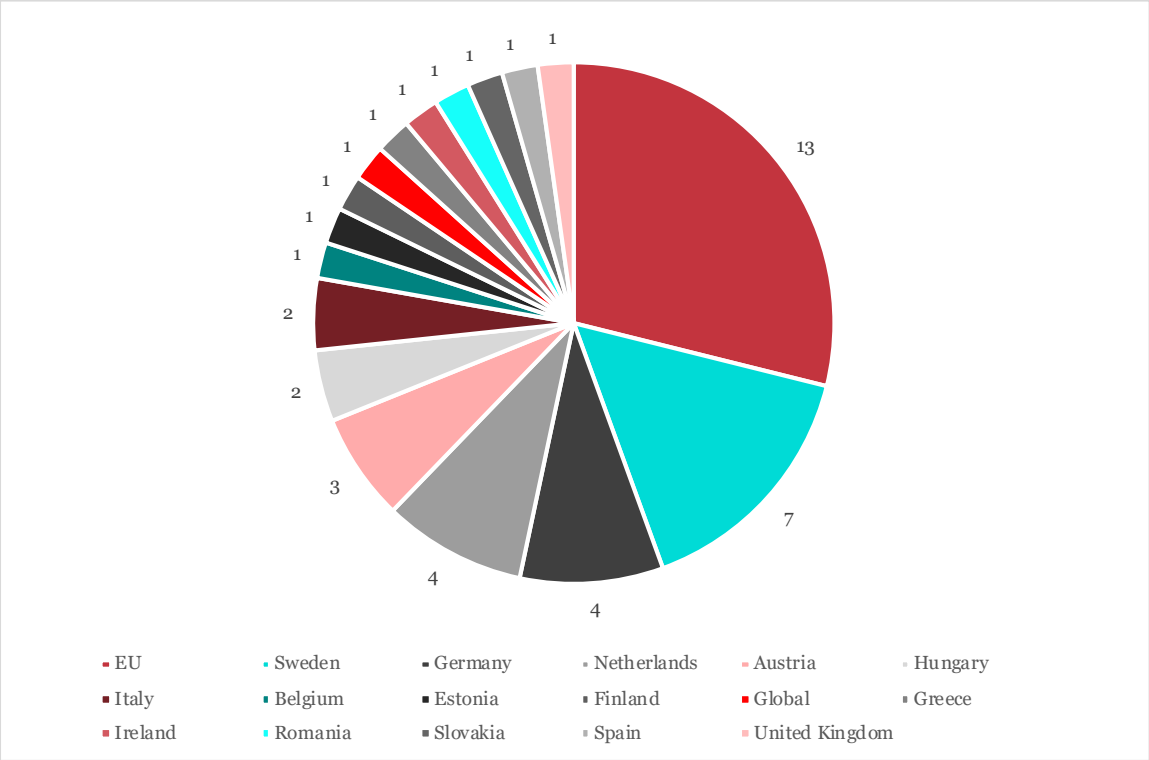
For better alignment with the rest of the final impact assessment report, and to maintain the anonymity of those who were the sole representative of a stakeholder category, interviewees were organised into the broader stakeholder categories/groups used in the main impact assessment report.. The corresponding numbers in each of these areas are shown in Table 22.

Table 22: Number of interviews per high level stakeholder group

High Level Category		Number	Share %	Chart
PRC	Private Research (companies)	19	42.22%	
REC	Research Centres (public)	12	26.67%	
PUB	Public, Non-Profit Organisations	14	31.11%	
Total		**45**	**100%**	

The Member States of each of the interviewees are summarised in Figure 23. Member states not listed in the figure have not been represented, these are Bulgaria, Croatia, Cyprus, Czechia, Denmark, France, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia and Slovenia.

Figure 23: Share of interviews per Member State



B.4.1 Approach to the targeted consultation

B.4.2 Key results/messages from the targeted consultation

Problems/barriers to the development of Safe and Automated Road transport which might be addressed through R&I Actions

Interviewees were asked to answer the questions in this section using the list items in Table 23.

The overall findings were that interviewees found the two most severe and relevant problems to be list item 1 and 2 – 'lack of coordinated R&I actions to improve technical and non-technical enablers for the development and deployment of novel CCAM technologies and systems' and 'lack of a shared strategic planning of research and pre-deployment programmes for CCAM'. The least severe and relevant problem was '5. low number of patents in Europe in this area' which also received the highest number 'wrong' answers (1 PRC, 1 PUB, 1 REC), meaning these interviewees felt it is not a barrier to the development of Safe and Automated Road transport. When asked if there were any items missing from list 1, the most common frequently mentioned additional problem/barrier was that 'policy and legislation is out-paced by technology, resulting in high barriers to on-road testing'.

The majority of interviewees felt that action at an EU level is required to overcome the barriers, this received 92% (304/331) of the total answers[36]. Although '5. low number of patents in Europe in this area' was the problem for which the most interviewees felt EU action isn't needed, a majority of 22 out of 29 still felt action is needed.

When asked if a European partnership is needed/helpful to overcome the barriers, the answers were split with approximately 3% (11/325) of total answers[36] being that it would

[36] (summed across each of the eleven problems/barriers)

not be helpful or necessary, 45% (146/325) being that it would be helpful and 52% (168/325) being that it is necessary. Participants were also asked if Horizon Europe calls could be enough to address the problems/barriers. For this, the majority felt that calls would not be enough with around 82% of the total answers[36] (243/296) being that calls alone would not be enough.

Table 23: List 1: Problems/barriers

List 1: Problems/barriers to the development of Safe and Automated Road transport which might be addressed through R&I actions	
Research and innovation problem	• Lack of coordinated R&I actions to improve technical and non-technical enablers for the development and deployment of novel CCAM technologies and systems. • Lack of a shared strategic planning of research and pre-deployment programmes for cooperative, connected and automated mobility (CCAM) • Lack of a common testing framework and insufficiently shared expertise in specific solutions • Gap between research and the development of innovative products and services in road mobility and also between developers and validators/certifiers. • Low number of patents in Europe in this area.
Structural and resource problems	• Limited collaboration and pooling of resources between public and private actors such as vehicle manufacturers, road operators, digital service providers, research centres and public organisations • Very high costs associated to testing new infrastructure and other equipment, and high risk associated to developing solutions that might not be up-taken later on.
Problems in uptake of innovations due to	• Market fragmentation due to R&I efforts not being sufficiently targeted towards systemic and interoperable solutions across the EU. • R&I efforts targeting relatively low technology levels rather than demonstration projects • Lack of synergies and synchronized innovation in related segments and value chains (e.g. telecommunications, digital maps, mobility as a service) Lack of consideration of societal or user needs; concerns with the uses of CCAM and their interaction with road safety, ethics and data privacy issues.

Opportunities brought about by Safe and Automated Road Transport

Interviewees were asked to answer the questions in this section using the list items in Table 24.

The overall findings were that interviewees found the two most relevant and important opportunities to be list item 2 and 4 – 'improved road safety' and 'reduced externalities of road transport (in particular pollutant and CO2 emissions) due to lower congestion and efficiency gains (e.g. from platooning)'. The least relevant opportunities were '8. New jobs and business opportunities in the sector' and '9. Reskilling opportunities for current workers', while the least important was '6. More convenience/comfort while travelling'. The opportunities that were met with the highest levels of disagreement (answered 'wrong') or uncertainty (answered 'unsure') were '10. Less expenditure required in road infrastructure expansion and maintenance' followed by '1. Improved traffic efficiency and less time spent in traffic'. When asked if there were any items missing from list 2, the most common frequently mentioned additional opportunity was that transport will be more inclusive in terms of geographical area not just demographic, meaning benefits will be brought to rural

areas. This was followed by the opportunity to introduce a new approach to mobility and mobility services and the benefits that come with that such as flexibility to have transport available at all hours and in shared spaces.

The majority of interviewees felt that action at an EU level is required to seize the opportunities, this received 88% (287/327) of the total answers[37]. Although '6. More convenience/comfort while travelling' was the opportunity for which the most interviewees felt EU action isn't needed, a majority of 22 out of 30 still felt action is needed. When asked if a European partnership is needed/helpful to overcome the barriers, the answers were split with approximately 10% (31/316) of total answers[36] being that it would not be helpful or necessary, 39% (123/316) being that it would be helpful and 51% (162/316) being that it is necessary.

Table 24: List 2: Opportunities

List 2: Opportunities brought about by Safe and Automated Road Transport	
Societal benefits/opportunities	• Improved traffic efficiency and less time spent in traffic • Improved road safety • More inclusive mobility • Reduced environmental externalities of road transport (in particular pollutant and CO2 emissions) due to lower traffic congestion and efficiency gains (e.g. from platooning). • Improved trust and awareness regarding such solutions. • More convenience/comfort while travelling
Economic/technological benefits/opportunities	• More innovative, sustainable and globally competitive CCAM industry and better-quality road infrastructure • New jobs and business opportunities in the sector • Reskilling opportunities for current workers • Less expenditure required in road infrastructure expansion and maintenance Reduced administrative burden for applicants and beneficiaries and reduced risk associated with investing in solutions that ultimately will not be deployed.

Objectives of research and innovation policy in the field of Safe and Automated Road Transport

Interviewees were asked to answer the questions in this section using the list items in Table 25.

In summary, interviewees found the most important objective to be '1. Improve safety and security of road transport', followed by '3. Reduce negative impacts, including congestion, air quality, energy consumption and climate change'. The objective that interviewees assigned the least importance to is '9. Mitigate risks linked to innovation by improving knowledge valorisation and handling of IPR' followed by '8. Increase the leverage of funding including more (private) co-financing'.

When asked if there were any important objectives missing from the list, the most prevalent, mentioned by 7 interviewees (3 PRC, 2 REC, 2 PUB) is that governance aspects need to be addressed. This was followed by a need to foster know-how, maintain interest in and value of European technology (1 PRC, 2 REC, 1 PUB) and societal planning to take

[37] (summed across each of the eleven problems/barriers)

into account user and societal needs and understand how CCAM can improve liveability, particularly in cities (0 PRC, 2 REC, 2 PUB).

The majority of interviewees felt that the objectives are appropriate, of the total answers from all stakeholder types across all the listed objectives, 95% (160/168) of the answers were 'appropriate'. The objective that is indicated to be the most inappropriate is '4. Increase the effectiveness of R&I and accelerate market take-up of innovative solutions, contributing to maintaining and extending industrial leadership', for which 3 out of 15 answered 'not appropriate'.

The majority of interviewees felt that a European partnership could contribute to meeting the objectives. Of the total answers, 62% (371/594) were that a partnership would have a high contribution, 34% (204/594) were that it would have a medium contribution and 3% (19/594) were that it would have a low contribution.

Table 25: List 3: Objectives

List 3: Objectives of R&I policy in the field of Safe and Automated Road Transport	
General objectives	Better align EU R&I efforts in the field of CCAM to: • Improve safety and security of road transport • Meet societal and market needs, including the inclusiveness and accessibility of mobility and more efficient traffic flows • Reduce negative impacts, including congestion, air quality, energy consumption and climate change • Increase the effectiveness of R&I and accelerate market take-up of innovative solutions, contributing to maintaining and extending industrial leadership
Specific objectives (related to the European Partnership	• Efficiently coordinate CCAM research and innovation and contribute to the appropriate sequencing of testing and pre-deployment actions • Foster focused and long-term investment in CCAM research and innovation, development and pre-deployment in line with EU policy objectives • Establish sustained networks and knowledge exchange between stakeholders • Increase the leverage of funding, including more (private) co-financing • Mitigate risks linked to innovation, by improving knowledge valorisation and handling of IPR • Increase the operational performance and effectiveness of R&I investments Ensure trust and awareness towards the benefits of CCAM in road transport

Research and innovation areas foreseen to address the problems/barriers (i.e., the draft scope of a potential partnership)

Interviewees were asked to answer the questions in this section using the list items in Table 26.

When combining the relevance and importance assigned by interviewees to each of the R&I actions listed, the most appropriate R&I action with the highest proportion answering 'high' for both relevance and importance was found to be '2. Cyber secure electronics…' followed by '5. Vehicle validation…'. The item interviewees found to be least important was '24. Workforce development…' followed by '13. Large-scale demonstration of e-shuttle pilots and other shared automated mobility solutions…'. In terms of relevance to a partnership, the action assigned the highest relevance by interviewees was '8. Physical and

digital infrastructure (PDI)…' followed by '21. EU-wide knowledge base, including common scenario database'. The lowest was assigned to '24. Workforce development…' followed by '17. Socio-economic and Environmental impact analysis'. Overall, the majority of interviewees answered with 'medium' which accounted for 54% (114/213) of the total answers, 46% (99/213) of the answers were 'high', and none answered with 'low'.

When asked if there were any important R&I actions missing from the list, the most frequently mentioned (0 PRC, 1 REC, 3 PUB) was that is necessary to establish how CCAM will function on a network level, not just as individual vehicles. This was followed by a comment on a lack of business R&I actions including cost-benefit analysis which was mentioned by 3 interviewees (1 PRC, 1 REC, 1 PUB) and a need service R&I actions to determine what the service will look like and how this will meet not just user demand but also user desires (1 PRC, 1 REC, 1 PUB).

The majority of interviewees felt that support at EU level is required for the R&I action areas. The action areas for which the highest proportion of interviewees answered that action at an EU level is required were '2. Cyber-secure Electronics…', '8. Physical and digital infrastructure (PDI)…', '9. Connectivity…' and '17. Socio-economic and Environmental impact analysis', for which 95% (18/19) answered in this way. The action for which the highest proportion of answers were that no support is required was '10. Artificial Intelligence…' for which 74% (14/19) answered that support at EU level is needed, followed by the action of '11. Smart, shared, automated mobility solutions…' for which 79% (15/19) answered that EU support is needed.

In terms of sequencing, '16. Societal needs analysis…' was assigned the lowest average sequence number, followed by '12. Governance…' meaning interviewees felt these should be the first areas to be addressed. '24. Workforce Development…' was assigned the highest sequence number, followed by '22. Common evaluation framework'. When asked if a partnership could contribute to the right sequencing in the implementation of these actions, the majority of interviewees answered with 'yes' with only 23 out of 383 (6%) answers being 'no'.

Table 26: List 4: R&I Actions

List 4: R&I action areas foreseen to address the problems/barriers (i.e., the draft scope of a potential partnership.
• Environment perception - Reliable environment perception to identify and predict all hazards of automated driving systems • Cyber-secure Electronics - Fail-operational and cyber secure electronic and software control architectures for CCAM • Passive and active safety for CCAM • On-board decision making – reliable localisation and dynamic map technologies, • Vehicle validation – physical and virtual assessment tools • Vehicle-user interaction – HMI design of connected and automated vehicles, harmonization and training requirements in vehicle-user interaction and international standardization of HMI • Tele-operation to ensure safety of CCAM in particularly complex and challenging situations • Physical and digital infrastructure (PDI) - PDI ecosystem for CCAM, covering e.g. infrastructure needs for different automation levels • Connectivity - secure solutions to facilitate and improve CCAM, Interaction between CAVs, infrastructure, and other road users • Artificial Intelligence - Concepts, techniques and models for CCAM • Smart, shared, automated mobility solutions - understand user acceptance and requirements of smart, shared, automated mobility solutions and foster the development of technologies and business models, in particular to encourage shared mobility • Governance - urban planning, link with public transport and its integration in fleet and traffic management

List 4: R&I action areas foreseen to address the problems/barriers (i.e., the draft scope of a potential partnership.
• Large-scale demonstration of e-shuttle pilots and other shared automated mobility solutions and its integration in the transport system • Large-scale demonstration of highly automated passenger cars • Large-scale demonstration pilots of automated commercial/heavy duty vehicles • Societal needs analysis - understand customer, market and societal expectations and opportunities • Socio-economic and Environmental impact analysis • Strategic European agenda for R&I and large-scale testing, including links with other R&I areas/partnerships • European framework for safe testing • Data exchange framework in the context of cross-border testing • EU-wide knowledge base, including common scenario database • Common evaluation framework • Data storage and sharing - Data storage and sharing for CCAM, aiming at a 'standard model' of data sharing (or the interoperability of coexistent models in view of competition • Workforce development - Labour market effects of connected and automated driving with the public and affected workers, and push and pull measures to facilitate the transition of work force

Issues of Effectiveness and Efficiency

The benefits most frequently mentioned by interviewees when asked 'What contribution can an institutional partnership make to the delivery of wider scale demonstration activities?' were that it would enable cross-sector and cross-border collaboration (2 PRC, 1 REC, 2 PUB) and that it would make managing the demonstrations easier in terms of budget, timescales and defining roles (1 PRC, 2 REC, 2 PUB). There were also negative contributions mentioned, the most popular of which were that it would take a long time to set up a partnership which would therefore introduce a delay (1 PRC, 1 REC, 0 PUB). When asked 'Do you think that other types of partnership, or the Horizon Europe programme alone, would enable their delivery?', the most common answer was that continuing with the Horizon Programme as it is now, with calls alone, isn't enough (3 PRC, 2 REC, 1 PUB). This was followed by preference for a co-programmed partnership (2 PRC, 1 REC, 1 PUB) but the same number of interviewees also felt that a co-programmed partnership is not strong enough (2 PRC, 1 REC, 1 PUB).

In answer to 'What would the effects of a future institutional partnership on leveraging of R&I investment be relative to other forms of partnership and Horizon Europe?' the most frequently mentioned impact, raised by two interviewees (1 PRC, 1 REC, 0 PUB), was that it will make it easier to determine a common vision which would bring a clarity that could encourage investment.

When discussing flexibility of a potential partnership, there was an overall preference for flexibility in both the objectives and R&I actions. For the former the margin, however, was small with 49% (22/45) answering with 'flexible' and 40% (18/45) answering with 'stable'. The results regarding the R&I actions were more significant with 75% (33/45) responding with 'flexible', 9% (4/45) with 'neither/unknown' and 5% (2/45) with 'stable'. The remainder of interviewees did not respond to the question.

Table 27: List 5: Types of Partnership

List 5: Reminder on the type of partnership
Option 0: Regular calls The priority is addressed at EU level by research and innovation activities funded through calls under regular work programmes.
Option 1 and 2 - Partnership Unlike regular calls, a European Partnership (options 1 and 2) could bring together a broader spectrum of stakeholders, both private sector (automotive and telecoms industry, operators) and public sector (academia, research organisations), and Member States (e.g. road transport and infrastructure authorities, national/regional programmes). This will be conducive to achieving the joint, well-coordinated actions and investment needed from public authorities and industries in several Member States in the European strategic value chain of 'connected, clean and autonomous vehicles' to ensure Europe stays or becomes a world industrial leader in this area.
Option 1: Co-programmed European Partnership This option involves creating a co-programmed partnership on the basis of memoranda of understanding and/or contractual arrangements between the Commission and the partners. The objectives of the partnership, related commitments for financial and/or in-kind contributions of the partners, key performance and impact indicators, and outputs to be delivered would be clearly specified. The Strategic Research Agenda developed by the industrial partners would be then implemented independently by the partners and through the Horizon Europe Work Programme and related calls for proposals.
Option 2: Institutionalised European Partnership (based on Article 187 TFEU) This option involves setting-up an institutional partnership with a strong coordination mechanism involving diverse public sector and private sector organisations. This option also involves combining and managing EU, national and private sector funding, including financial contributions from the EU, and in-kind and financial contributions from Member States and from the industry. The objectives of the partnership, related commitments for financial and/or in-kind contributions of the partners, key performance and impact indicators, and outputs to be delivered would be clearly specified. Note: other options for partnerships (Article 185 TFEU and co-funded ones) are not considered suitable because the initiative targets both the public sector and industry.

Types of Members

When asked if the potential member types should be involved in a partnership, the majority of interviewees answered 'yes' across all of the potential member types. The member type for which there was the least support was '8. Other services (e.g. repair)', followed by '7. Insurance companies'. Interviewees were also asked to identify any member types they felt should be involved in a potential partnership that had not been included in List 6. Those mentioned by the most interviewees were NGOs (0 PRC, 2 REC, 2 PUB) and SMEs (1 PRC, 2 REC, 1 PUB). In addition to the further member types that were suggested, there were also some changes recommended to those already existing on the list. Of these, the most frequently mentioned was that car industry should be changed to vehicle or automotive industry (5 PRC, 1 REC, 2 PUB).

In terms of financial involvement, administrative support and policy decision-making '1. Member State' received the most votes for involvement. For general decision-making it was a combination of '1. Member States', '3. Road Authorities' and '4. Car Industry'. The member types '3. Road Authorities' and '14. Entities representing road users' received the

highest number of votes for their involvement with stakeholder engagement. For Research and innovation, both '4. Car industry' and '12. Companies providing ITS solutions' received the maximum number of votes for their involvement given the number of interviewees that answered.

When asked how flexible the member types' commitment should be, the majority of answers across the different member types were 'flexible' (51% (128/251)), followed by 'stable' (37% (93/251). The remainder of the answers were 'neither/unknown'. This preference for flexibility was prevalent for the member types of '5. Other industries', followed by '6. Research bodies' and '13. Other technology providers'. The member type for which the most interviewees felt their commitment should be stable was '1. Member States', followed by '2. Other public authorities' and '3. Road Authorities'. Overall, there was a preference for a strong coordination mechanism between public sector and private sector organisations with 53% (24/45) responding with 'strong', 2% (1/45) responding with 'not strong' and 9% (4/45) answering with 'neither/unknown'.

Table 28: List 6: Types of Members

List 6: Potential member types
1. Member States
2. Other public authorities (municipalities, cities)
3. Road Authorities
4. Car industry
5. Other industries
6. Research bodies
7. Insurance companies
8. Other services (e.g. repair)
9. Public Transport authorities or companies
10. Other transport and logistics companies
11. Telecom network operators
12. Companies providing ITS solutions
13. Other technology providers
14. Entities representing road users.

The Partnership

When asked how they would see their role in a partnership, the largest proportion of interviewees wanted to take an advisory role (3 PRC, 5 REC, 6 PUB), this was followed by those that wanted to be involved with research and innovation (3 PRC, 7 REC, 3 PUB) and those that felt they could play the role of a facilitator, bringing stakeholders to the table and ensuring those they represented had were able to feed into the partnership (4 PRC, 4 REC, 5 PUB). When asked how they would expect to benefit from a partnership, interviewees felt they would benefit at a personal/individual organisation level from access to knowledge, results, findings or data (2 PRC, 6 REC, 4 PUB). Following this was an expectation that all would benefit from co-ordination between all stakeholders (including public and private) resulting in joint target-setting and vision (4 PRC, 1 REC, 4 PUB).

The majority of interviewees were willing to put a high amount of effort into the initial generation of a partnership. Of those that answered the question, 50% (14/28) responded with 'high', 39% (11/28) responded with 'medium' and 11% (3/28) responded with 'low'. In terms of the duration over which they would be willing to participate in the negotiations, the majority of those that answered the question responded with 'short'[38] (76% (22/29)), followed by 'medium' (21% (6/29)), followed by 'long' (3% (1/29)). Many of those that

[38] Timescales given in the questionnaire were short (1-2 years), medium (3-8 years), long (>8 years).

responded with 'short' felt that a partnership needs to be set up as soon as possible in order to keep up with the global pace of CCAM.

In terms of how willing interviewees would be to share knowledge as part of the partnership, the majority responded with 'willing' across each of the partnership options. The partnership option under which there were the most 'willing' responses and no 'not willing responses' was the co-programmed partnership. Each of the other responses received one 'not willing' response.

When asked which partnership option they preferred, the majority of interviewees replied that they would prefer a co-programmed partnership, this was chosen by 61% (20/33) of those that answered the question. Just over half this number preferred an institutionalised partnership, which was chosen by 36% (12/33) of those that answered. Only a single interviewee, representing a research organisation, felt that traditional calls under the standard Horizon Programme would be best.

Interviewees felt that a partnership for Safe and Automated Road Transport would most benefit from a relationship with bodies working towards mobility solutions and MaaS. This was followed by Zero emissions, although where interviewees specified a preferred level of involvement, it was for discussions only. The areas for which active collaboration through working together on projects, etc. was suggested were MaaS and smart cities.

B.5 Open public consultation on the Candidate institutionalised European Partnerships

B.5.1 Approach to the open public consultation

The consultation was open to everyone via the EU Survey online system.[39] The survey contained two main parts and an introductory identification section. The two main parts collected responses on general issues related to European partnerships (in Part 1) and specific responses related to 1 or more of the 12 candidate initiatives (as selected by a participant).

The survey contained open and closed questions. Closed questions were either multiple choice questions or matrix questions that offered a single choice per line, on a Likert-scale. Open questions were asked to clarify individual choices.

The survey was open from 11 September till 12 November 2019. The consultation was available in English, German and French. It was advertised widely through the European Commission's online channels as well as via various stakeholder organisations.

The analysis of the responses was conducted by applying descriptive statistic methods to the answers of the closed questions and text analysis techniques to the analysis of the answers of the open questions. The keyword diagrams in this report have been created by applying the following methodology: First, the open answer questions were translated into English. This was followed by cleaning of answers that did not contain relevant information, such as "NA", "None", "no comment", "not applicable", "nothing specific", "cannot think of any", etc. In a third step, common misspellings were corrected, such as "excellence" instead of "excellence", or "partnership" instead of "partnership". Then, then raw open answers were tokenised (i.e. split into words), tagged into parts of speech (i.e. categorised as a noun, adjective, preposition, etc) and lemmatised (i.e. extraction of the root of each word) with a pre-trained annotation model in the English language. At this point, the second phase of manual data cleaning and correction of the automatic categorisation of words into parts of speech was performed. Finally, the frequency of appearance and co-occurrences of words and phrases were computed across the dataset and the different sub-

[39] https://ec.europa.eu/eusurvey/runner/ConsultationPartnershipsHorizonEurope

sets (e.g. partnerships, stakeholder groups). Data visualisations were created based on that output.

The keyword graphs in the following sections have been built based on the relationships between words in the open responses of the survey participants. It features words that appear in the same answer either one after the other or with a maximum distance of two words between them. Each keyword is represented as a node and each co-occurrence of a pair of words is represented as a link. The size of the nodes and the thickness of the links vary according to the number of times that keywords are mentioned and their co-occurrence, respectively. In order to facilitate the visualisation of the network, the keyword graphs have been filtered to show the 50 most common co-occurrences. Although the keywords do not aim to substitute a qualitative analysis, they assist the identification of the most important topics covered in the answers and their most important connections with other topics, for later inspection in the set of raw qualitative answers.

B.5.2 Overview of respondents to the open public consultation

Profile of respondents

In total, 1635 respondents filled in the questionnaire of the open public consultation. Among them, 272 respondents (16.64%) were identified to have responded to the consultation as part of a campaign (coordinated responses). Based on the Better Regulation Guidelines, the groups of respondents where at least 10 respondents provided coordinated answers were labelled as *'campaigns',* segregated and analysed separately and from other responses. In total 11 campaigns were identified. In addition, 162 respondents in the consultation also display similarities in responses but in groups smaller than 10 respondents. Hence, these respondents were not labelled as campaigns and therefore were not analysed separately from the general analysis.

Among the 1635 respondents, 1178 (72.05%) completed the online consultation in English, 141 (8.62%) in German, 89 (5.44%) in French, 58 (3.55%) in Italian and 47 (2.87%) in Spanish, see Figure 24. Respondents that belong to the 11 campaigns follow the same pattern of language distribution, with English being the dominant language of respondents in that group. Table 29 shows that over 50% of respondents come from 4 Western and Southern European countries – Germany, Italy, France and Spain. Overall, the number of respondents from Eastern and Northern Europe is lower, while among non-EU countries the greater number of respondents come from Switzerland, Norway and Turkey, which are countries associated to the Framework Programme. In the group of respondents labelled as campaigns, most respondents are from Germany (48 respondents or 17.65%), France (39 respondents or 14.34%), Italy (37 respondents or 13.6%), Belgium (23 respondents or 8.46%), the Netherlands (21 respondents or 7.72%) and Spain (17 respondents or 6.25%). Hence, a similar pattern of country of origin is observed in the entire sample of respondents and for the campaigns.

Across all respondents 40.80% indicated to answer to the open public consultation in a public way (non-anonymous) and 20.67% of all respondents indicated their Transparency Register number.

Figure 24: Language of the consultation that selected respondents (N=1635) (non-campaign replies) Aggregation of responses of all candidate initiatives

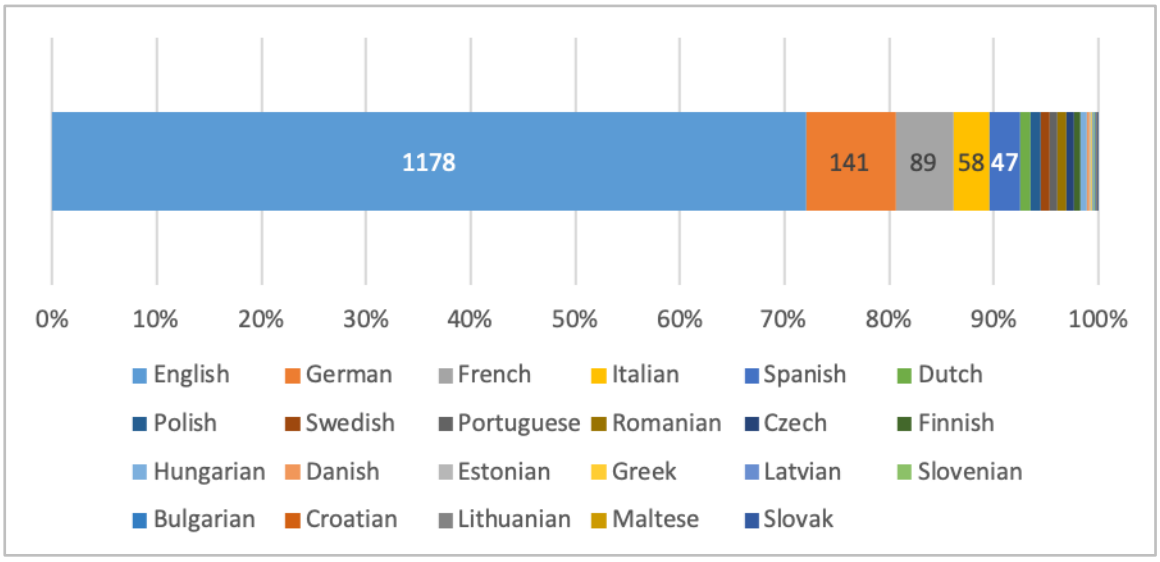


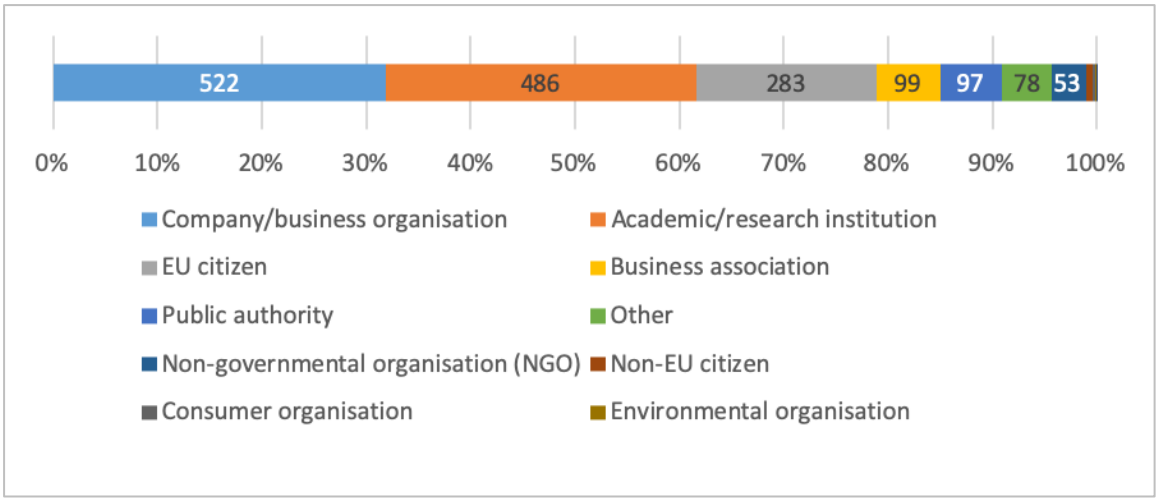
Table 29: Country of origin of respondents (N=1635)

Country	Number of respondents	Percentage of respondents
Germany	254	15.54%
Italy	221	13.52%
France	175	10.70%
Spain	173	10.58%
Belgium	140	8.56%
The Netherlands	86	5.26%
Austria; United Kingdom	61	3.73%
Finland	49	3.00%
Sweden	48	2.94%
Poland	45	2.75%
Portugal	32	1.96%
Switzerland	28	1.71%
Czechia	24	1.47%
Greece	23	1.41%
Norway; Romania	22	1.35%
Denmark	20	1.22%
Turkey	19	1.16%
Hungary	14	0.86%
Ireland	12	0.73%
United States	11	0.67%

Country	Number of respondents	Percentage of respondents
Estonia; Slovakia; Slovenia	10	0.61%
Bulgaria; Latvia	9	0.55%
Bosnia and Herzegovina	7	0.43%
Lithuania	4	0.24%
Canada; Croatia; Israel	3	0.18%
China; Ghana; Iceland; Japan; Luxembourg; Morocco	2	0.12%
Bhutan; Botswana; Cyprus; Iran; Malta; Mexico; Moldova; Mongolia; Palestine; Russia; Serbia; South Africa; Tunisia; Ukraine; Uruguay	1	0.06%

According to Figure 25, the three biggest groups of respondents are companies and business organisations (522 respondents or 31.93%), academic and research institutions (486 respondents or 29.72%) and EU citizens (283 respondents or 17.31%). Business associations, representing multiple businesses, were the fourth largest responding group (99 respondents or 6.05%), no other types of associations were presented amongst the selectable options for respondents. Among the group of respondents that are part of campaigns, most respondents are provided by the same groups of stakeholders, namely companies and business organisations (121 respondents or 44.49%), academic and research institutions (54 respondents or 19.85%) and EU citizens (42 respondents or 15.44%).

Figure 25: Type of respondents (N=1635) (non-campaign replies) Aggregation of responses of all candidate initiatives



Respondents were asked to indicate the organisational size of the companies, organisations and institutions they work for. Based on Table 30, a greater number of respondents work in large companies and business organisations (295 respondents out of 522 or 56.51%) and large academic and research institutions (348 respondents out of 486 or 71.60%). A greater number of respondents that are employed by business associations and NGOs indicated an organisation size of 1 to 9 employees. Among the group of respondents that are marked as campaigns, a greater number of respondents work in large companies and business organisations (82 respondents out of 121 or 67.77%) and academic and research institutions (39 out of 54 respondents or 72.22%).

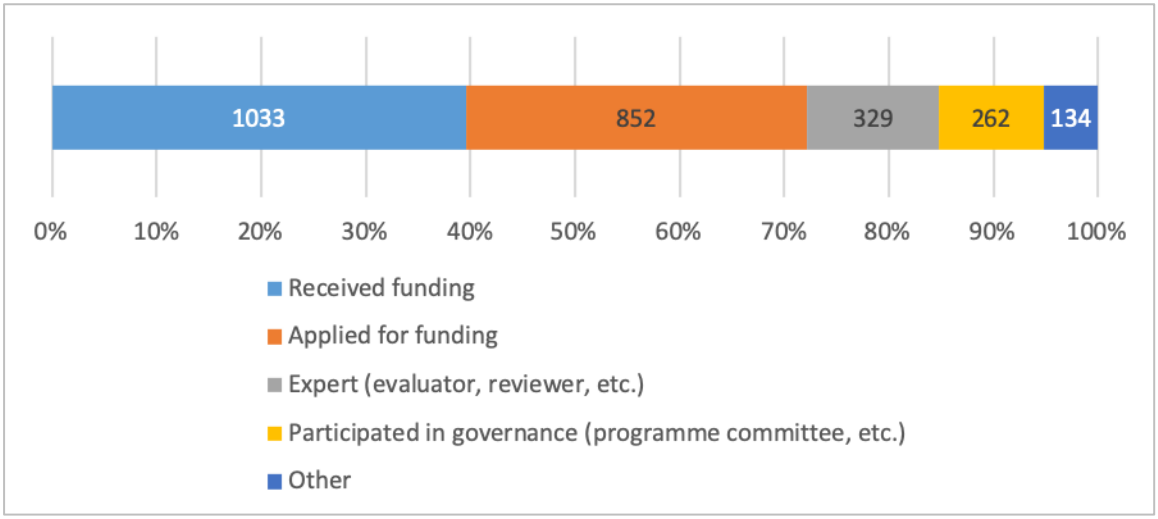
Table 30: Size of organisations that represent consultation respondents (N=1635)

	Organisation size			
Type of respondents' organisations	**Large (250 employees or more)**	**Medium (50 to 249 employees)**	**Small (10 to 49 employees)**	**Micro (1 to 9 employees)**
Company/business organisation	295	66	90	71
Academic/research institution	348	95	31	12
Business association	15	6	34	44
Public authority	58	33	6	0
Non-governmental organisation (NGO)	7	9	11	26
Consumer organisation	1	0	2	1
Environmental organisation	0	0	1	0
Trade union	0	0	1	0
Other	24	16	19	19

Among all consultation respondents, 1303 (79.69%) have been involved in the on-going research and innovation framework programme Horizon 2020 or the preceding Framework Programme 7, while 332 respondents (20.31%) were not. In the group of campaign respondents, the share of those who were involved in these programmes is higher (245 respondents out of 272 or 90.07%) than in the group of non-campaign respondents (1058 out of 1363 or 77.62%). When respondents that participated in the Horizon2020 or in the preceding Framework Programme 7 were asked to indicate in which capacity they were involved in these programmes, the majority stated that they were a beneficiary (1033 respondents or 39.58%) or applicant (852 respondents or 32.64%).

The main stakeholder categories, e.g. companies/business organisation, academic/research institutions, etc., show a similar distribution across the capacities in which they 'have been involved in Horizon 2020 or in the Framework Programme 7' as the overall population of consultation respondents (see distribution in Figure 26). However, a few stakeholder categories have mainly been involved in the capacity of "Received funding" and/or "Applied for funding", this applies to business associations, NGOs and public authorities.

Figure 26: Capacity in which respondents were involved in Horizon 2020 or in the Framework Programme 7 (N=1303)(non-campaign replies) Aggregation of responses of all candidate initiatives, multiple options allowed



Among those who have been involved in the on-going research and innovation framework programme Horizon 2020 or the preceding Framework Programme 7, 1035 respondents (79.43%) are/were involved in a partnership. The share of respondents from campaigns that are/were involved in a partnership is higher than for non-campaign respondents, 89.80% versus 77.03% respectively. The list of partnerships under Horizon 2020 or its predecessor Framework Programme 7 together with the numbers, percentages of participants is presented in Table 31, the table also shows the key stakeholder categories for each partnership.

Most consultation respondents participated in the following partnerships: Fuel Cells and Hydrogen 2 (FCH2) Joint Undertaking, Clean Sky 2 Joint Undertaking, European Metrology Programme for Innovation and Research (EMPIR) and in Bio-Based Industries Joint Undertaking. The comparison between the non-campaign and campaign groups of respondents shows that the overall distribution is quite similar. However, there are some differences. For the campaign group almost a half of respondents is/was involved in the Fuel Cells and Hydrogen 2 (FCH2) Joint Undertaking, a higher share of campaign respondents is/was participating in Clean Sky 2 Joint Undertaking and in Single European Sky Air Traffic Management Research (SESAR) Joint Undertaking.

Table 31: Partnerships in which consultation respondents participated (N=1035)

Name of the partnership	Number and % of respondents from both groups (n=1035)	Number and % of respondents from a non-campaign group (n=815)	Academic/research institutions	Business associations	Company/business organisations	Company/business organisations	EU citizens	NGOs	Public authority
Fuel Cells and Hydrogen 2 (FCH2) Joint Undertaking	354 (33.33%)	247 (30.31%)	97	9	37	43	41	8	5
Clean Sky 2 Joint Undertaking	195 (18.84%)	145 (17.79%)	57	2	10	27	37	1	7
European Metrology Programme	150 (14.49%)	124 (15.21%)	64	0	13	9	14	2	19

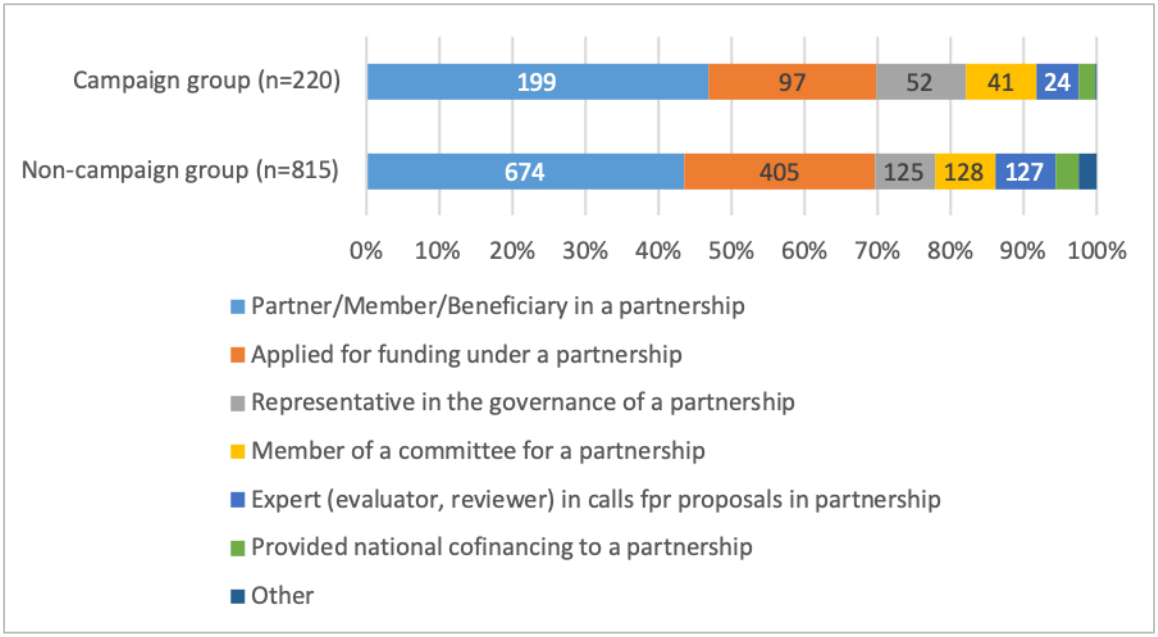
Name of the partnership	Number and % of respondents from both groups (n=1035)	Number and % of respondents from a non-campaign group (n=815)	Academic/research institutions	Business associations	Company/business organisations	Company/business organisations	EU citizens	NGOs	Public authority
for Innovation and Research (EMPIR)									
Bio-Based Industries Joint Undertaking	142 (13.72%)	122 (14.97%)	39	8	20	27	14	1	6
Shift2Rail Joint Undertaking	124 (11.98%)	101 (12.40%)	31	7	5	31	14	3	7
Electronic Components and Systems for European Leadership (ECSEL) Joint Undertaking	111 (10.72%)	88 (10.80%)	42	2	7	20	12	0	5
Single European Sky Air Traffic Management Research (SESAR) Joint Undertaking	66 (6.38%)	46 (5.64%)	10	3	3	20	3	2	3
5G (5G PPP)	53 (5.12%)	47 (5.77%)	20	1	6	14	5	0	1
Eurostrars-2 (supporting research-performing small and medium-sized enterprises)	44 (4.25%)	40 (4.91%)	17	0	6	1	7	0	6
Innovative Medicines Initiative 2 (IMI2) Joint Undertaking	37 (3.57%)	35 (4.29%)	18	2	3	3	2	4	3
Partnership for Research and Innovation in the Mediterranean Area (PRIMA)	28 (2.71%)	26 (3.19%)	15	0	3	1	2	0	2

Name of the partnership	Number and % of respondents from both groups (n=1035)	Number and % of respondents from a non-campaign group (n=815)	Academic/research institutions	Business associations	Company/business organisations	Company/business organisations	EU citizens	NGOs	Public authority
European and Developing Countries Clinical Trials Partnership	25 (2.42%)	24 (2.94%)	12	0	1	2	3	3	2
Ambient Assisted Living (AAL 2)	22 (2.13%)	21 (2.58%)	11	2	1	1	3	0	3
European High-Performance Computing Joint Undertaking (EuroHPC)	22 (2.13%)	18 (2.21%)	6	0	2	3	5	0	2

When respondents were asked in which role(s) they participate(d) in a partnership(s), over 40% indicated that they act(ed) as partner/member/beneficiary in a partnership (see Figure 27). The second largest group of respondents stated that they applied for funding under a partnership. The roles selected by non-campaign and campaign respondents are similar.

The few respondents that selected "Other" as their role were provided with the opportunity to outline their role. A total of 25 people did provided description. The answers provided were very varied and could not be clustered in sub-groups, a few examples are: former communication and stakeholder relationship officer, chair of steering board, system engineer, grant manager, Joint Programming Initiative (JPI), or a role in advocacy of the partnership.

Figure 27: Role of respondents in a partnership (N=1035) (non-campaign replies) Aggregation of responses of all candidate initiatives



In the open public consultation respondents could provide their views on each of the candidate Institutionalised European Partnerships, and each respondent could select multiple partnerships to provide their views on. The table below presents the number and percentage of respondents for each partnership. It is visible that the majority of respondents (31.37%) provided their views on the Clean Hydrogen candidate partnership. More than 45% of respondents from the campaigns selected this partnership. Around 15% of all respondents provided their views for the candidate partnerships European Metrology, Clean Aviation and Circular bio-based Europe. The share of respondents in the campaign group that chose to provide views on the Clean Aviation candidate partnership is of 20%. The smallest number of respondents provided opinions on the candidate initiative 'EU-Africa research partnership on health security to tackle infectious diseases – Global Health'.

Table 32: Future partnerships for which consultation respondents provide responses (N=1613)

Name of the candidate Institutionalised European partnership	Number and % of respondents from both groups (n=1613)	Number and % of respondents from a non-campaign group (n=1341)	Academic/research institutions	Business associations	Company/business organisations (<250)	Company/business organisations (250+)	EU citizens	NGOs	Public authority
Clean Hydrogen	506 (31.37%)	382 (28.49%)	123	21		55	74	8	13
European Metrology	265 (16.43%)	225 (16.78%)	112	3	21	11	34	3	28
Clean Aviation	246 (15.25%)	191 (14.24%)	57	5	21	34	54	3	8
Circular bio-based Europe: sustainable Innovation for	242 (15%)	215 (16.03%)	63	19	36	35	31	7	13

Name of the candidate Institutionalised European partnership	Number and % of respondents from both groups (n=1613)	Number and % of respondents from a non-campaign group (n=1341)	Academic/research institutions	Business associations	Company/business organisations (<250)	Company/business organisations (250+)	EU citizens	NGOs	Public authority
new local value from waste and biomass									
Transforming Europe's rail system	184 (11.41%)	151 (11.26%)	29	14	23	39	31	2	7
Key Digital Technologies	182 (11.28%)	162 (12.08%)	55	13	20	22	35	5	7
Innovative SMEs	111 (6.88%)	110 (8.20%)	19	12	39	4	14	4	10
Innovative Health Initiative	110 (6.82%)	108 (8.05%)	35	6	9	12	16	16	5
Smart Networks and Services	109 (6.76%)	107 (7.98%)	34	9	12	17	21	2	6
Safe and Automated Road Transport	108 (6.70%)	102 (7.61%)	25	12	11	19	10	3	9
Integrated Air Traffic Management	93 (5.77%)	66 (4.92%)	8	7	4	24	9	2	7
EU-Africa research partnership on health security to tackle infectious diseases – Global Health	49 (3.04%)	47 (3.50%)	15	2	4	3	12	6	4

Campaigns per candidate Institutionalised European Partnership

As was mentioned above, 11 campaigns were identified, the largest of them includes 57 respondents. The table below presents the campaigns that replied for each candidate partnership. As presented, the candidate Institutionalised Partnership Clean Hydrogen has the highest number of campaigns, namely 5. A few partnerships, such as Innovative SMEs, Smart Networks and Systems, were not targeted by campaigns. Some campaign respondents decided to provide opinions about several partnerships, therefore, campaign #2 and #6 feature in several partnerships.

Table 33: Overview of campaigns across partnerships

Name of the candidate Institutionalised European partnership	Number of a campaign group (total number of respondents in a campaign)	Number of respondents that provided views about a partnership
Clean Hydrogen	Campaign #1 (57 respondents)	57 respondents
	Campaign #2 (41 respondents)	25 respondents
	Campaign #7 (18 respondents)	18 respondents
	Campaign #9 (14 respondents)	13 respondents
	Campaign #11 (10 respondents)	9 respondents
Clean Aviation	Campaign #2 (41 respondents)	17 respondents
	Campaign #6 (19 respondents)	19 respondents
	Campaign #8 (14 respondents)	13 respondents
Integrated Air Traffic Management	Campaign #2 (41 respondents)	10 respondents
	Campaign #6 (19 respondents)	12 respondents
European Metrology	Campaign #3 (36 respondents)	35 respondents
Circular bio-based Europe: sustainable Innovation for new local value from waste and biomass	Campaign #5 (20 respondents)	20 respondents
Transforming Europe's rail system	Campaign #4 (31 respondents)	29 respondents
Key Digital Technologies	Campaign #10 (12 respondents)	12 respondents
Innovative SMEs	-	-
Innovative Health Initiative	-	-
Smart Networks and Services	-	-
Safe and Automated Road Transport	-	-
EU-Africa research partnership on health security to tackle infectious diseases – Global Health	-	-

B.5.3 Responses to the open public consultation at programme level

The following section of the report presents the analysis of responses at programme level, meaning all respondents (excluding campaigns) were included, independent of which candidate European Partnerships respondents selected to provide their views on. The results for responses as part of campaigns are presented separately.

Characteristics of future candidate European Partnerships

Respondents were asked to assess what areas, objectives, aspects need to be in the focus of the future European Partnerships under Horizon Europe and to what extent. According to Figure 28, a great number of respondents consider that a significant contribution by the future European Partnerships is 'fully needed' to achieve climate-related goals, to the development and effective deployment of technology and to EU global competitiveness in specific sectors/domains. Overall, respondents' views reflect that many aspects require attention of the Partnerships. The least attention should be paid to responding towards priorities of national, regional R&D strategies, including smart specialisation strategies, according to respondents.

Overall, only minor differences can be found between the main stakeholder categories. Academic/research institutions value the responsiveness towards EU policy objectives and focus on development and effective deployment of technology a little less than other respondents. Business associations, however, find that the future European Partnerships under Horizon Europe should focus a little bit more on the development and effective deployment of technology than other respondents. Furthermore, business associations, large companies as well as SMEs (companies with less than 250 employees) value role of the future European Partnerships for significant contributions to EU global competitiveness in specific sectors domains a little higher than other respondents. Finally, both NGOs and Public authorities put a little more emphasis on the role of the future European Partnerships for significant contributions to achieving the UN SDGs.

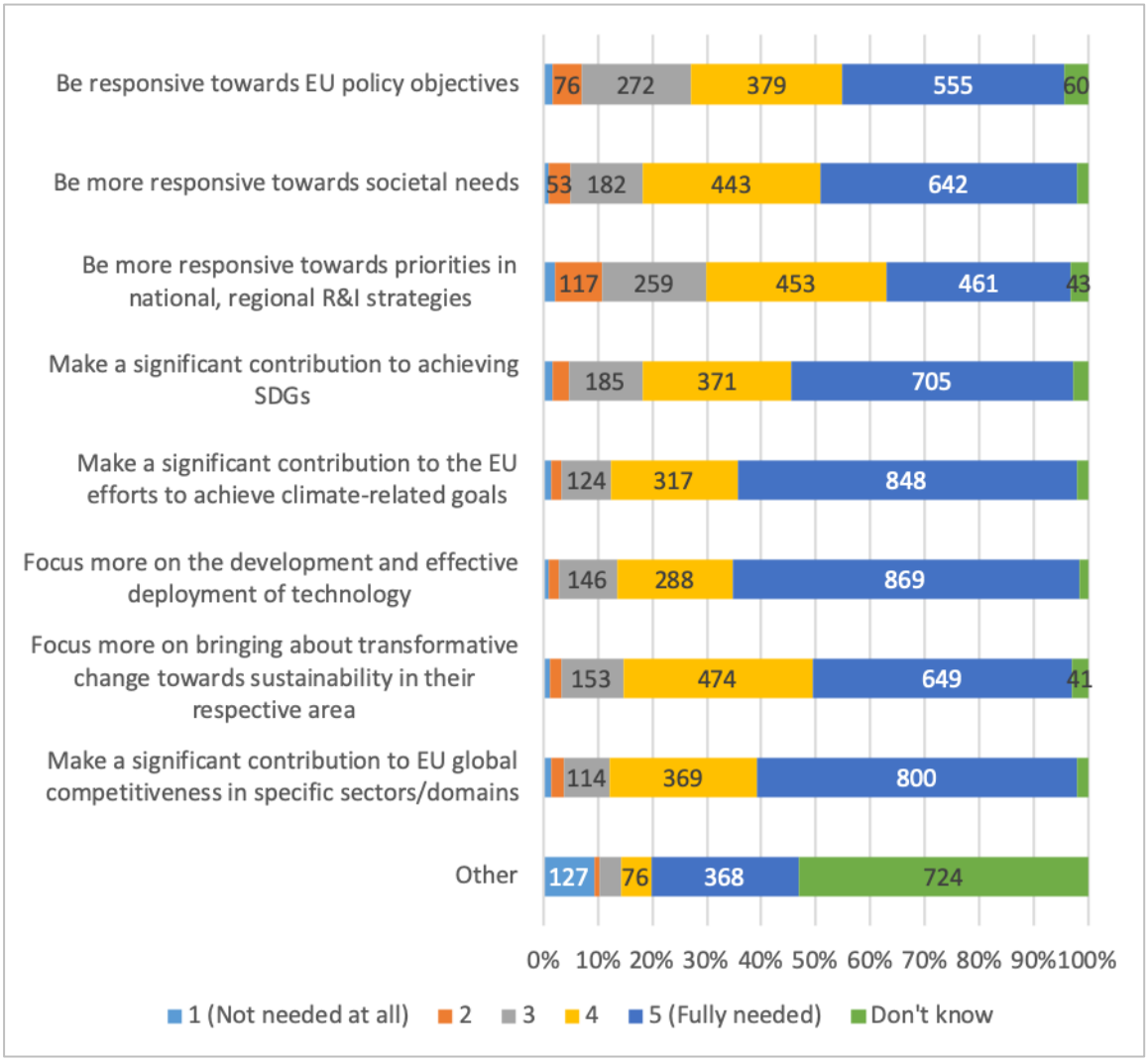
The views of citizens (249, or 18.27%), both EU and non-EU citizens, that participated in the open public consultation do not reflect significant differences with other types of respondents. However, respondents that are/were directly involved in a partnership under Horizon 2020 or its predecessor Framework Programme 7 assign a higher importance of the future European Partnerships to be more responsive towards EU policy objectives and to make a significant contribution to achieving the UN's Sustainable Development Goals.

Among 272 respondents that are classified as **campaigns,** the majority (86.76%) indicated that the future European Partnerships should focus more on the development and effective deployment of technology. Other categories of presented needs that received a high score among many campaign respondents are the need to make a significant contribution to the EU efforts to achieve climate-related goals, Sustainable Development Goals and to EU global competitiveness in specific sectors/domains. The least number of campaign respondents valued the need to be more responsive towards priorities in national, regional R&I strategies (54 respondents gave a score "5 Fully needed", or 19.85%) and to be more responsive towards societal needs (71 respondents gave a score "5 Fully needed", or 26.10%).

Similarly as for non-campaign respondents, we find only minor differences between the main stakeholder categories amongst campaign respondents. Academic/research institutions indicated that the future European Partnerships need to focus a little less on development and effective deployment of technology than other respondents. On the contrary, large companies find the focus on the development and effective deployment of technology a little more needed than other respondents, as do public authorities. Furthermore, large companies feel responsiveness towards priorities in national, regional R&I strategies is a little less needed than other respondents. Public authorities, however,

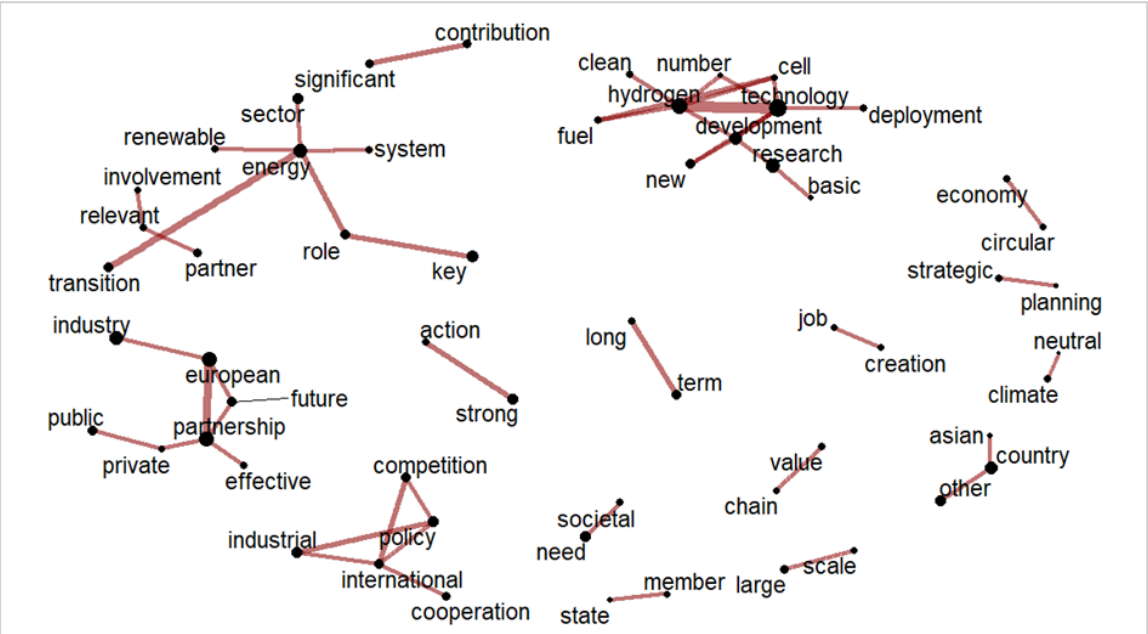
value the responsiveness towards societal needs and priorities in national, regional R&I strategies more than others.

Figure 28: To what extent do you think that the future European Partnerships under Horizon Europe need to (N=1363) (non-campaign replies) Aggregation of responses of all candidate initiatives



The analysis of the open answers provided to explain the "Other" field show that many respondents included the set-up of public-private European partnerships and the link between industrial policy and international competition and cooperation (see Figure 29). This is confirmed through qualitative analysis of answers, many of which mention the importance of collaboration and integration of relevant stakeholders to tackle main societal challenges and to contribute to policy goals. Against this backdrop, fragmentation of funding and research efforts across Europe should be avoided. Additionally, several respondents suggested that faster development and testing of technologies, acceleration of industrial innovation projects, science transfer and market uptake are deemed as priorities. Next to that, many respondents provided answers related to the fields of hydrogen and the energy transition, which corresponds to the high number of respondents that provided answers to the candidate European Partnership specific questions related to these topics.

Figure 29: Assessment of needs, open answers to "Other" field, 50 most common co-occurring keywords (N=734) (non-campaign replies) Aggregation of responses of all candidate initiatives



Many of the respondents that are classified as campaigns took the opportunity of the "Other" field to underline their key messages. The main aspects mentioned were:

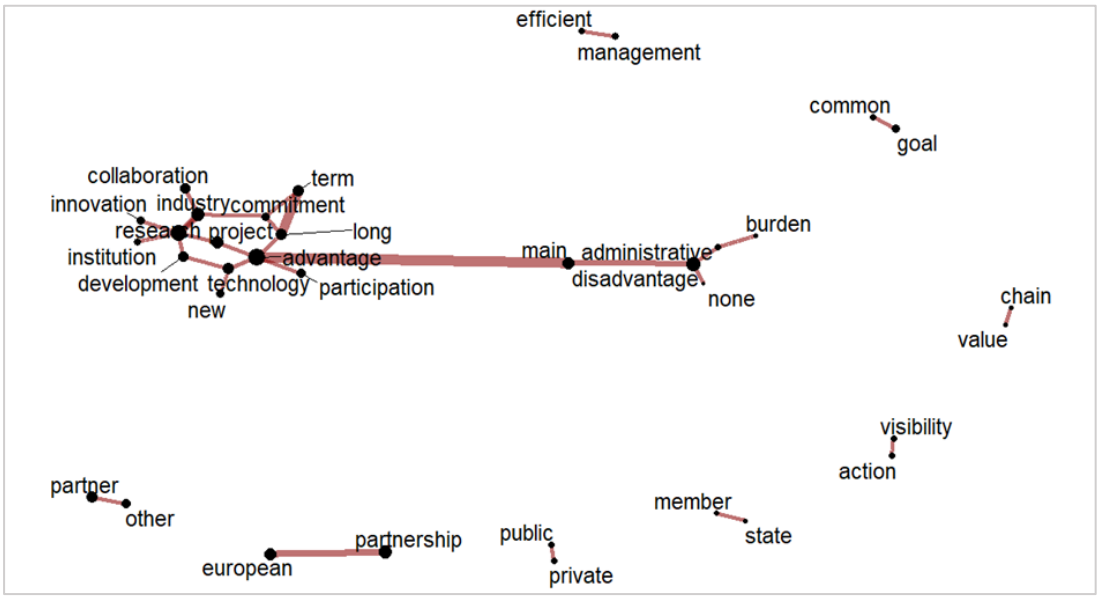
- The global positioning of Europe: outlining the role of global competition (including the role of technology), the importance of autonomy for Europe and the ability of Europe to act as a key player at the global level.
- The balance between policy objectives and private sector interests: Partnerships are regarded as an instrument to secure industry commitments due to the stability required for investments that serve policy goals.
- The importance of the transition between research and innovation (implementing research results in the market).
- The importance of multidisciplinary, and specifically cross-sectoral/cross-partnership collaboration.
- The importance of the long term commitment of a wide range of relevant stakeholders.

Next to that many respondents as part of campaigns stressed the importance of the energy transition, hydrogen and the environment, which corresponds to the high number of respondents that provided answers to the candidate European Partnership specific questions related to these topics.

Main advantages and disadvantages of Institutionalised European Partnerships

In the next question, respondents were asked to outline the main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe. This was an open question for which a keyword analysis was used (see the main results in Figure 30). As can be observed, the advantages mentioned focus on the development of technology, overall collaboration between industry and research institutions, and the long-term commitment. Disadvantages mentioned are mainly administrative burdens.

Figure 30: What would you see as main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe? (non-campaign replies) Aggregation of responses of all candidate initiatives, 30 most common co-occurring keywords (N=1551)



When asked about the main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe, the following points were mentioned by respondents that are classified as campaigns:

Advantages:

- Long term commitment, stability, and visibility in financial, legal, and strategic terms
- Participation of wide range of relevant stakeholders in an ecosystem (large/small business, academics, researchers, experts, etc.)
- Complementarity with other (policy) initiatives at all levels EU, national, regional
- Efficient and effective coordination and management
- High leverage of (public) funds
- Some innovative field require high levels of international coordination/standardisation (at EU/global level)
- Ability to scale up technology (in terms of TRL) through collaboration
- Networking between members
- Direct communication with EU and national authorities

Disadvantages:

- Slow processes
- System complexity
- Continuous openness to new players should be better supported as new participants often bring in new ideas/technologies that are important for innovation
- Lower funding percentage compared to regular Horizon Europe projects
- Cash contributions
- Administrative burdens

- Potential for IPR constraints

Relevance of EU level efforts to address problems in selected areas of Partnerships

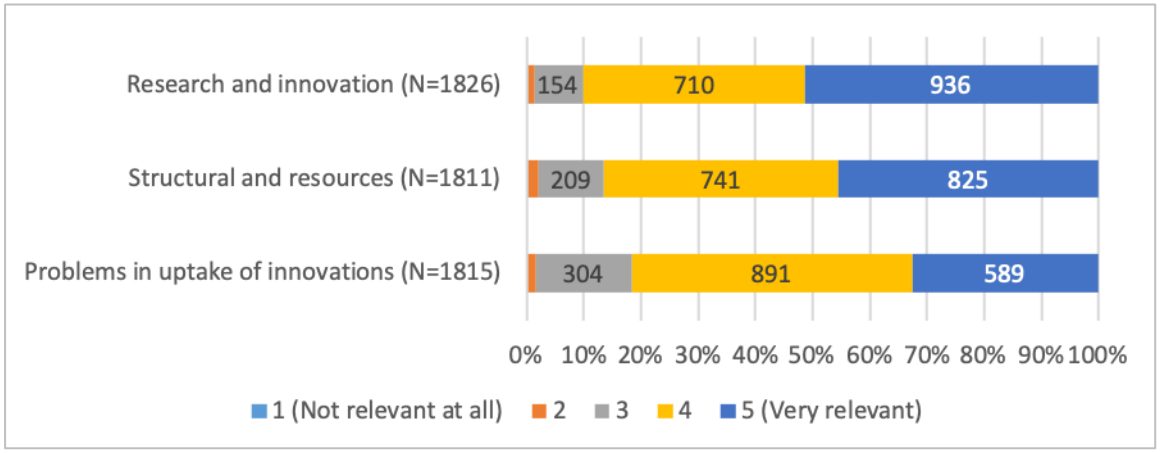
Per candidate European Partnership respondents were asked to rate the relevance of partnership specific problems in three main areas: Research and innovation problems, Structural and resource problems and Problems in the uptake of innovations. To aggregate results the average of the responses on partnership specific problems were calculated.

As presented in Figure 31, research and innovation related problems were rated as most relevant by the respondents across all candidate initiatives, followed by structural and resources problems and problems in the uptake of innovations. Overall, all three areas were deemed (very) relevant across the partnerships, as more than 80% of respondents found these challenges (very) relevant.

Only minor differences were found between the main stakeholder categories of respondents. Research and innovation problems were found slightly more relevant by academic/research institutions, yet slight less relevant by large companies and SMEs. Structural and resource problems were indicated as slightly more relevant by NGOs, but slightly less by academic/research institutions. While both NGOs and public authorities find it slightly more relevant to address problems in uptake of innovation than other respondents.

The views of citizens, both EU and non-EU citizens, are the same as other respondents (no significant differences). Respondents that are/were directly involved in a current/preceding partnership (Horizon 2020 or Framework Programme 7) find, however, the uptake of innovation problems slightly more relevant than other respondents.

Figure 31: To what extent do you think this is relevant for research and innovation efforts at EU level to address the following problems in relation to the candidate partnership in question? (non-campaign replies) Aggregation of responses of all candidate initiatives

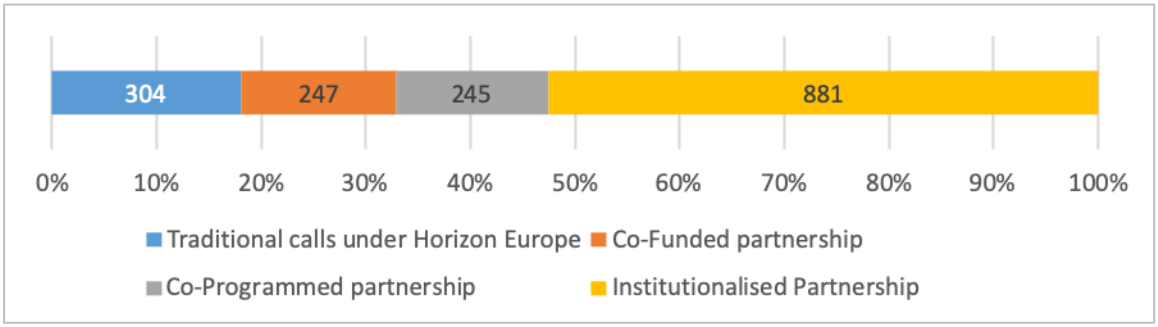


Horizon Europe mode of intervention to address problems

After providing their views on the relevance of problems, respondents were asked to indicate how these challenges could be addressed through Horizon Europe intervention. As shown in Figure 32, just over 50% of all respondents indicated that institutionalised partnerships were the best fitting intervention, however, relatively strong differences between stakeholder categories were found. The intervention of institutionalised partnerships was indicated more by business associations and large companies, but less by academic/research institutions and SMEs. While academic/research institutions valued traditional calls more often, this was not the case for business associations, large companies and public authorities. Public authorities indicated a co-programmed intervention more often than other respondents. Citizens, compared to other respondents,

indicated slightly less often that institutionalised partnerships were the best fitting intervention. Respondents that are/were directly involved in a current/preceding partnership, however, selected the institutionalised partnership intervention in far higher numbers (nearly 70%).

Figure 32: In your view, how should the specific challenges described above be addressed through Horizon Europe intervention? (non-campaign replies) Aggregation of responses of all candidate initiatives



When asked to reflect on their answers, respondents that pointed to the need for using the "institutionalised partnership" intervention mentioned the long-term commitment of collaboration, a common and ambitious R&I strategy as well as the overall collaboration between industry and research institutions. Respondents that referred to possible approaches, sometimes gave examples of good experiences in with other interventions:

- Traditional calls because of their flexibility and integration of a wide range of actors, as long as the evaluation panels do not deviate from the policy premier. This was mentioned by 94 participants, evenly distributed across companies (25 of them), academics (26) and EU citizens (25).
- Co-funded partnership, as a mechanism to ensure that all participants take the effort seriously, while allowing business partnerships to develop. This approach was deemed suitable based on previous experiences with ERANETs. This was raised by 84 participants, 36 of them academic respondents, 18 companies and 16 EU citizens.
- Co-programmed partnerships to tackle the need to promote and engage more intensively with the private sector. This was mentioned by 97 participants, most of them companies (34), followed by academics (22), business associations (15) and EU citizens (11).

Relevance of a set of elements and activities to ensure that the proposed European Partnership would meet its objectives

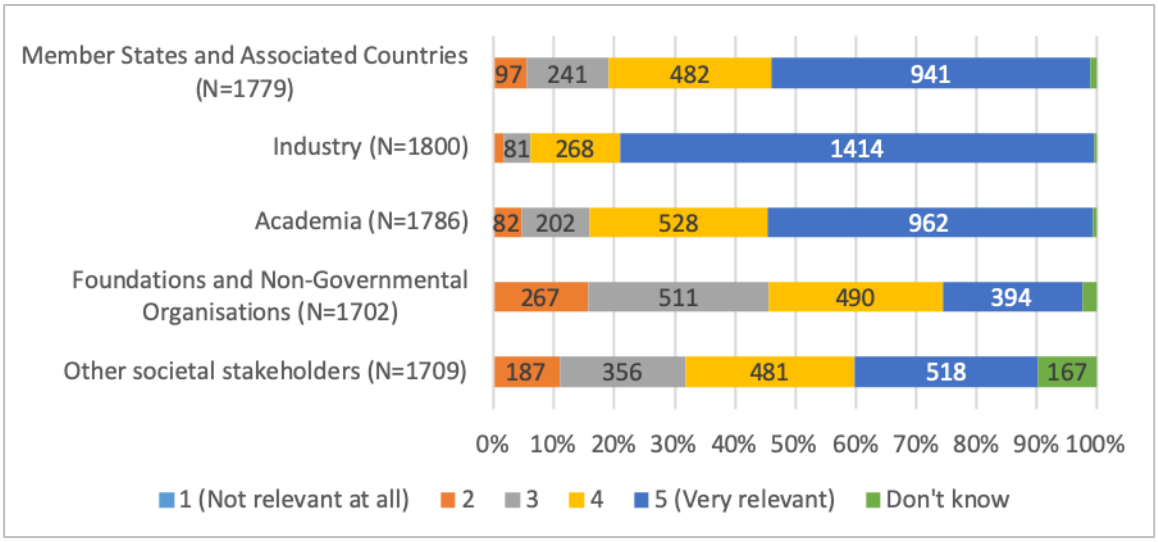
Setting joint long-term agendas

Respondents were asked how relevant it is for the proposed European Partnerships to meet their objectives to have a strong involvement of specific stakeholder groups in setting joint long-term agenda. As presented in Figure 33, collectively all respondents see stakeholders from industry as the most relevant, followed by academia and governments (Member States and Associated Countries). The involvement of foundations and NGOs as well as other societal stakeholders were, however, still found to be (very) relevant by more than 50% of the respondents.

When looking at the differences between the answers of the main stakeholder categories only minor differences could be found. Overall, it could be observed that most respondents indicated the stakeholder group they belong to themselves or that represent them as relevant to involve. Academic/research institutions find it more relevant to involve academia and less relevant to involve industry when compared to other respondents. The other way around large companies, SMEs and business associations find it more relevant to involve industry and less relevant to involve academia, Member States and Associated

Countries and NGOs. The involvement of Member States and Associated Countries was found more relevant by academic/research institutions and public authorities. NGOs also values their own involvement and those of other societal stakeholders more than other respondents. views of citizens also show a slightly higher relevance for foundations and NGOs. This is less so the case for respondents that are/were directly involved in a current/preceding partnership (most predominantly companies and academia).

Figure 33: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives - Setting joint long-term agenda with strong involvement of: (non-campaign replies) Aggregation of responses of all candidate initiatives

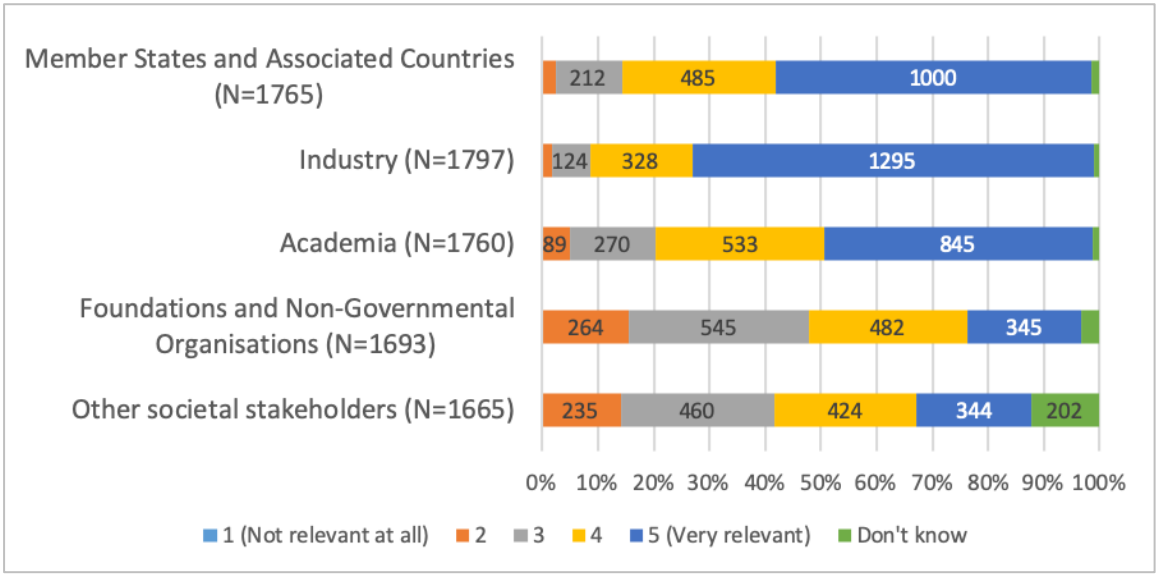


Pooling and leveraging resources through coordination, alignment and integration with stakeholders

Respondents were also asked how relevant it is for the proposed European Partnership to meet its objectives to pool and leverage resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with specific groups of stakeholders. As shown in Figure 34-similarly as for the previous questions-, respondents also see stakeholders from industry as the most relevant, followed by academia and governments (Member States and Associated Countries). The involvement of foundations and NGOs as well as other societal stakeholders are also still found to be (very) relevant for more than 50% of the respondents.

Similarly as described for the question on setting joint long-term agendas, most stakeholder categories valued their own involvement higher than other respondents – although also here differences between stakeholder categories were minor. As such, academic/research institutions see the relevance of academia higher, while large companies, SMEs and business association indicated a lower relevance of academia than other respondents. Similarly, these private sector stakeholders valued the relevance of industry higher than others while valuing the relevance of NGOs and other societal stakeholders less. NGOs value themselves and other societal stakeholders however higher than other respondents, and also public authorities indicated a higher relevance for Member States and Associated Countries then other respondents. Citizens mainly put more emphasis on the role of NGOs and other societal stakeholders then other respondents.

Figure 34: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Pooling and leveraging resources (financial, infrastructure, in-kind expertise, etc.) through coordination, alignment and integration with: (non-campaign replies) Aggregation of responses of all candidate initiatives

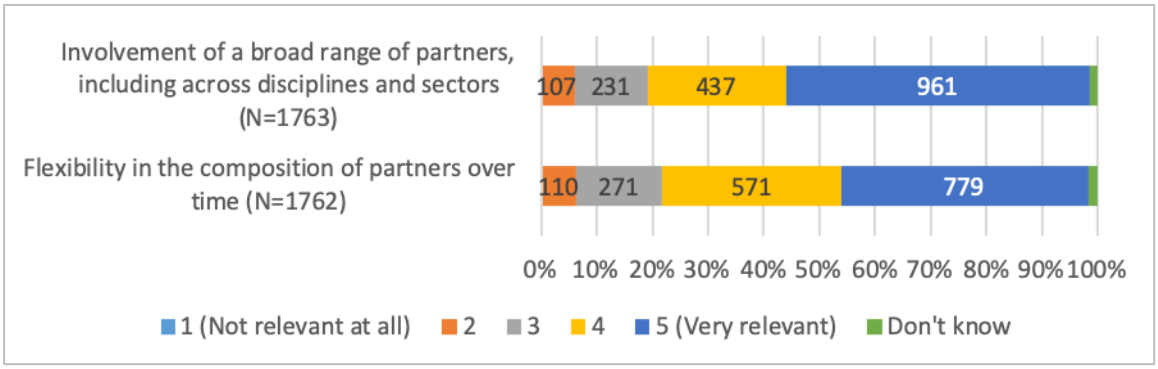


Composition of the partnerships

Regarding the composition of the partnership most respondents indicated that for the proposed European Partnership to meet its objectives the composition of partners needs to be flexible over time and that a broad range of partners, including across disciplines and sectors, should be involved (see Figure 35).

When comparing stakeholder groups only minor differences were found. Academic/research institutions and public authorities found the involvement of a broad range of partners and flexibility in the composition of partners over time slightly more relevant than other respondents, while large companies found both less relevant. SMEs mainly found the flexibility in the composition of partners over time less relevant than other respondents, while no significant differences were found regarding the involvement of a broad range of partners. Citizens provided a similar response to non-citizens. Respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, indicated a slightly lower relevance of the involvement of a broad range of partners and flexibility in the composition of partners over time.

Figure 35: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Partnership composition (non-campaign replies) Aggregation of responses of all candidate initiatives

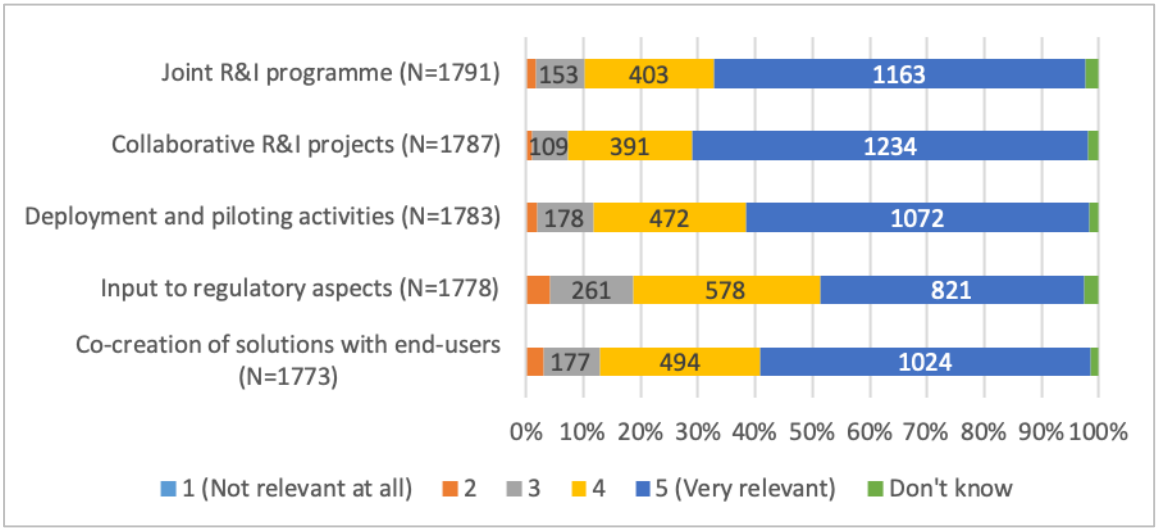


Implementation of activities

Most respondents indicated that implementing activities like a joint R&I programme, collaborative R&I projects, deployment and piloting activities, providing input to regulatory aspects and the co-creation of solutions with end-users are all (very) relevant for the partnerships to be able to meet its objectives (see Figure 36).

Minor differences were found between the main stakeholder categories, the differences found were in line with their profile. As such, academic/research institutions found joint R&I programme & collaborative R&I projects slightly more relevant and deployment and piloting activities, input to regulatory aspects and co-creation with end-users slightly less relevant than other respondents. For SMEs an opposite pattern is shown. Large companies, however, also found collaborative R&I projects slightly more relevant than other respondents, as well as input to regulatory aspects. The views of citizens are similar to non-citizens. Respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, show a slightly higher relevance across all activities shown in Figure 36.

Figure 36: In your view, how relevant are the following elements and activities to ensure that the proposed European Partnership would meet its objectives – Implementing the following activities (non-campaign replies) Aggregation of responses of all candidate initiatives



Relevance of setting up a legal structure (funding body) for the candidate European Partnerships to achieve improvements

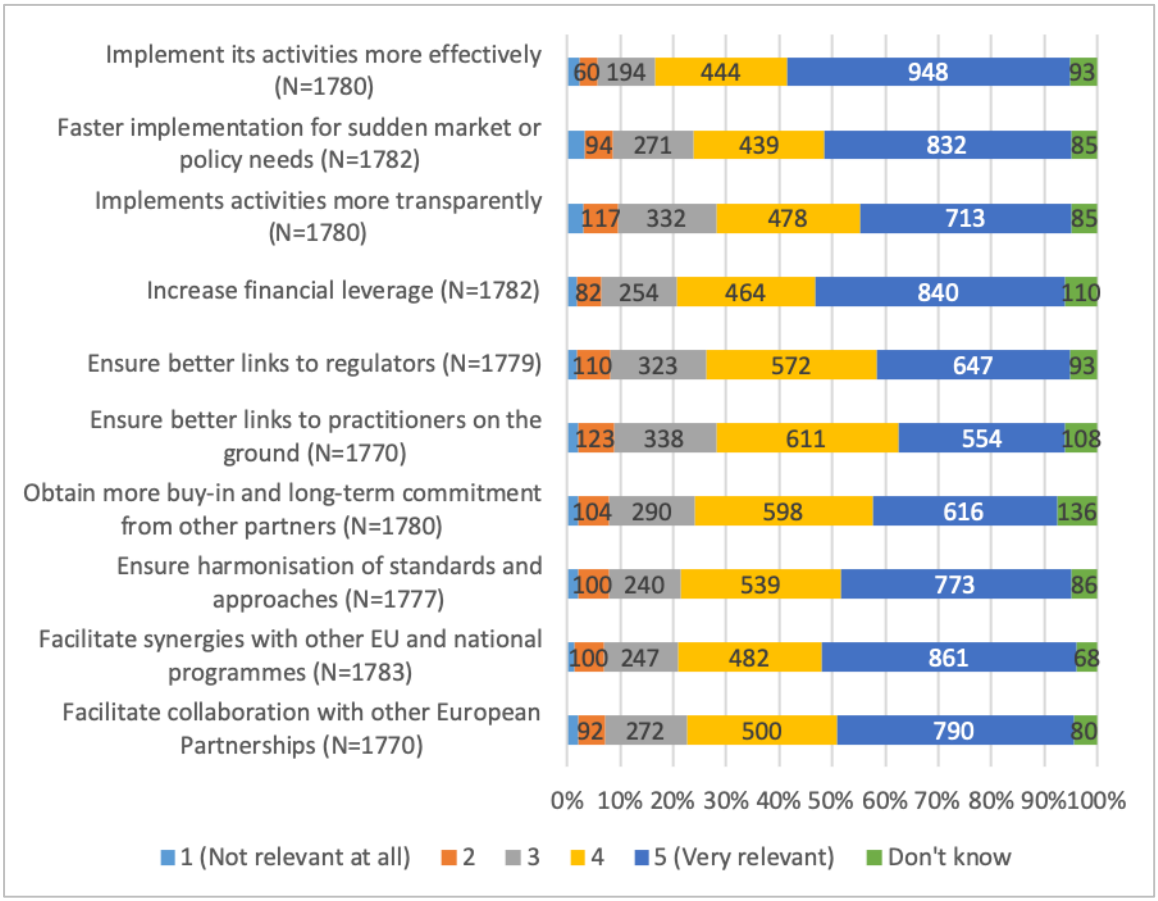
Respondents were then asked to reflect on the relevance of setting up a legal structure (funding body) for achieving a set of improvements, as presented in Figure 37. In general, 70%-80% of respondents find a legal structure (very) relevant for these activities. The legal structure was found most relevant for implementing activities in a more effective way and least relevant for ensuring a better link to practitioners on the ground, however differences are small.

When comparing the main stakeholder categories we found minor differences. Academic/research institutions indicated a slightly lower relevance for transparency, better links to regulators as well as obtaining the buy-in and long-term commitment of other partners. SMEs also indicated a lower relevance regarding obtaining the buy-in and long-term commitment of other partners. Large companies showed a slightly higher relevance for implementing activities effectively, ensure better links to regulators, obtaining the buy-in and long-term commitment of other partners, synergies with other EU/MS programmes and collaboration with other EU partnerships than other open consultation respondents. NGOs find it slightly more relevant to implement activities faster for sudden market or

policy needs. Public authorities, however, find it slightly less relevant to facilitate collaboration with other European Partnerships than other respondents.

The views of citizens show a slightly lower relevance for a legal structure in relation to implementing activities in an effective way. Quite different results are shown for respondents that are/were directly involved in a current/preceding partnership when compared to respondents not involved in a current/preceding partnership, they indicated a higher relevance across all elements presented in Figure 37.

Figure 37: In your view, how relevant is to set up a specific legal structure (funding body) for the candidate European Partnership to achieve the following? (non-campaign replies) Aggregation of responses of all candidate initiatives



Scope and coverage of the candidate European Partnerships based on their inception impact assessments

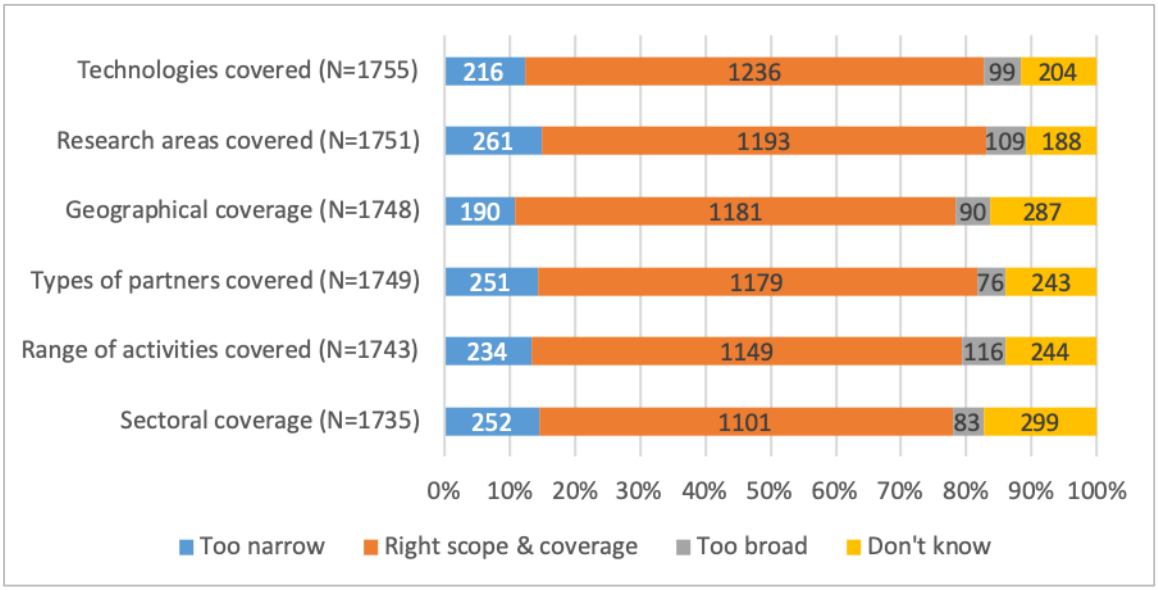
The response regarding the scope and coverage for the partnerships, based on inception impact assessments, shows that the large majority feels like the scope and coverage initially proposed in the inception impact assessments is correct. Figure 38 shows the results. However, about 11% to 15% of the respondents indicated the scope and coverage to be too narrow. About 11%-17% of respondents answered "Don't know". In the open answers respondents mostly reflected on specific aspects of the geographical and sectoral scope and coverage of the specific candidate European Partnerships, no overall lessons could be extracted.

Overall, differences between the main stakeholder categories were found to be minor. Academic/research institutions indicated slightly more often that the research area was "too narrow" then other respondents. SMEs on the other hand indicated slightly more often that the research area and the geographical coverage were "too broad". NGOs and public authorities, however, found the geographical coverage slightly more often "too narrow" when compared to other respondents. Large companies found the range of activities

slightly more often "too broad" and the sectoral focus slightly more often "too narrow" when compared to other respondents.

The views of citizens are the same as for other respondents. Most notably, respondents that are/were directly involved in a current/preceding partnership, when compared to respondents not involved in a current/preceding partnership, more often indicated that the candidate institutionalised European Partnership have the "right scope & coverage".

Figure 38: What is your view on the scope and coverage proposed for this candidate institutionalised European Partnership, based on its inception impact assessment? (non-campaign replies) Aggregation of responses of all candidate initiatives



Scope for rationalisation and alignment of candidate European Partnerships with other initiatives

When asked whether it would be possible to rationalise a specific candidate European Institutionalised Partnership and its activities, and/or to better link with other comparable initiatives, nearly two thirds of respondents answered "Yes" (1000, or 62.15%), while over one third answered "No" (609, or 37.85%). Nearly no differences were found between the main stakeholder categories, only large companies and SMEs indicated slightly more often "Yes" in comparison to other respondents.

The views of citizens are the same as for other respondents. Respondents that are/were directly involved in a current/preceding partnership, indicated "No" more often, the balance is about 50/50 between "Yes" and "No" for this group.

In the open responses respondents often referred to specific similar/comparable and complementary initiatives discussing the link with a specific candidate European Partnership, no overall lessons could be extracted, but more detailed results can be found in the partnership specific result sections.

Relevance of European Partnerships to deliver targeted scientific, economic/technological and societal impacts

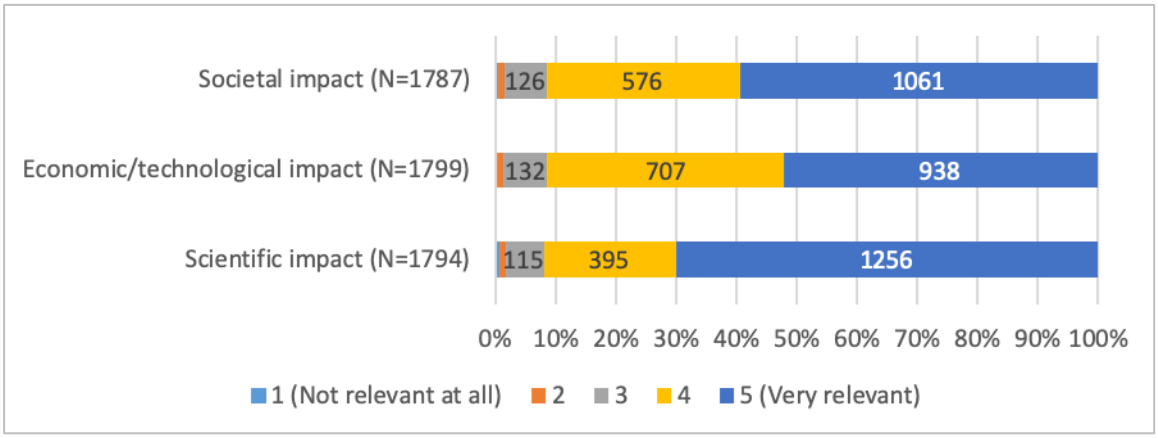
Finally, respondents were asked to rate the relevance of partnership specific impacts in three main areas: Societal impacts, Economic/technological impacts and Scientific impacts. To aggregate results the average of the responses on partnership specific impacts were calculated.

As presented in Figure 39, overall, all three areas were deemed (very) relevant across the candidate partnerships. Scientific impact was indicated as the most relevant impact, more than 90% of respondents indicated that these impacts were (very) relevant.

Only minor difference between stakeholder groups were found. Academic/research institutions found scientific impacts slightly more relevant, while large companies found economic and technological impacts slightly more relevant than other respondents. NGOs found societal impact slightly more relevant, while SMEs found this slightly less important.

Citizens, both EU and non-EU citizens, did not a significantly different view when compared to other respondents. Respondents that are/were directly involved in a current/preceding partnership find all impacts slightly more relevant than other respondents.

Figure 39: In your view, how relevant is it for the candidate European Institutionalised Partnership to deliver on the following impacts? (non-campaign replies) Aggregation of responses of all candidate initiatives



B.6 Responses to the open public consultation for the candidate partnership "Safe And Automated Road Transport"

B.6.1 Introduction

This section outlines the results of the Open Public Consultation for the candidate European Partnership on Safe and Automated Road Transport. The section outlines the following:

- Results on general questions, segregated for this candidate European Partnership:
  - Views on the needs of the future European Partnerships under Horizon Europe
  - Views on the advantages and disadvantages of participation in an Institutionalised European Partnership
- Results on specific questions for this candidate European Partnership:
  - Relevance of research and innovation efforts at the EU level to address problems
  - Views on Horizon Europe interventions to address these problems
  - Views on the relevance of elements and activities in: setting a joint long-term agenda; pooling and leveraging resources; partnership composition; implementation of activities.
  - Views on setting up a specific legal structure (funding body)
  - Views on the proposed scope and coverage of this candidate European Partnership
  - Views on the alignment of the European Partnership with other initiatives
  - Relevance of this candidate European Partnership to deliver impacts

B.6.2 Characteristics of respondents

There are 102 respondents who have answered (part of) the consultation for the Safe and Automated Road Transport Partnership. Of these respondents, 11 (10.78%) were citizens. The largest group of respondents were businesses with 30 respondents (29.41%), closely followed by academic and research institutions with 25 respondents (24.51%). There were 12 respondents from business associations. The other respondents were representatives of public authorities (9, 8.82%), non-governmental organisations (3, 2.91%) or other (10,

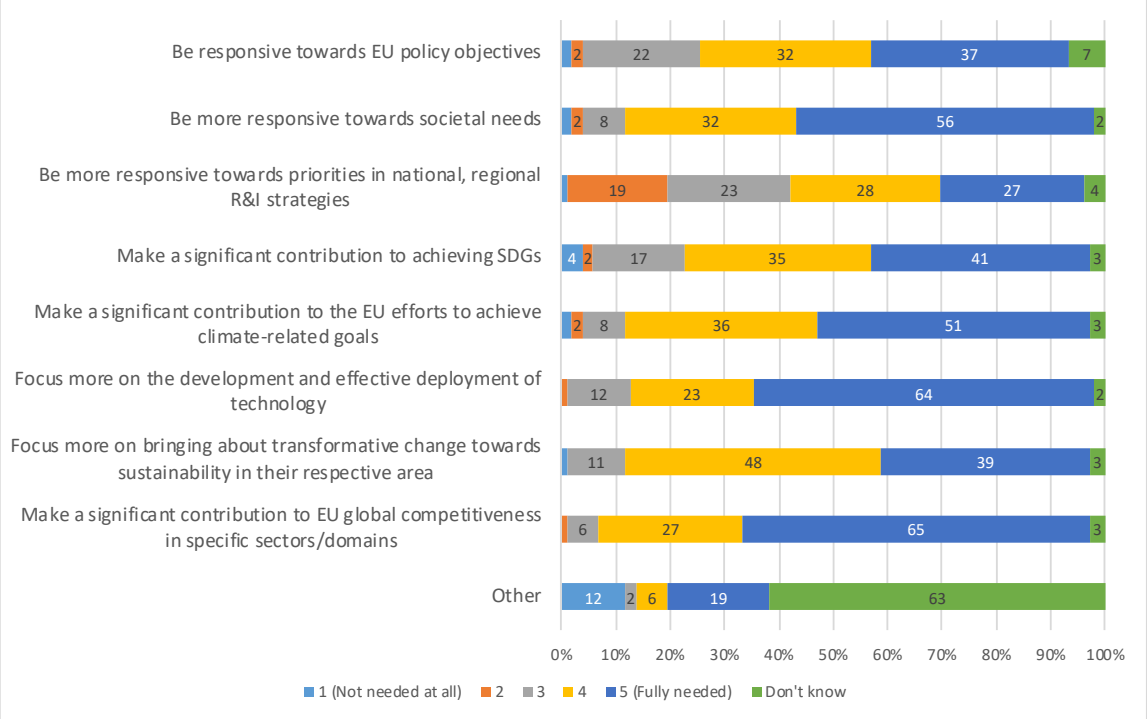
9.98%). There was one respondent from a Trade Union. Over two-thirds of respondents, namely 79 (77.45%), have been involved in the on-going research and innovation framework programme, of which 47 respondents (59.49%) were directly involved in a partnership under Horizon 2020 or its predecessor Framework Programme 7.

B.6.3 Characteristics of future candidate European Partnerships – as viewed by respondents to the Safe and Automated Road Transport initiative

At the beginning of the consultation, the respondents were asked to indicate their views of the needs of the future European Partnerships under Horizon Europe. All 102 respondents answered this questions. Overall, a large part of the respondents indicated that many of these needs were fully needed. The option where most respondents indicated this, was making a significant contribution to EU global competitiveness in specific sectors/domains (65, 63.73%), closely followed by focusing more on the development and effective deployment of technology (64, 62.75%). Aside from 'other', the need where the least amount of respondents indicated that improvements were fully needed, was being more responsive towards priorities in national and/or regional R&I strategies (27, 26.47%).

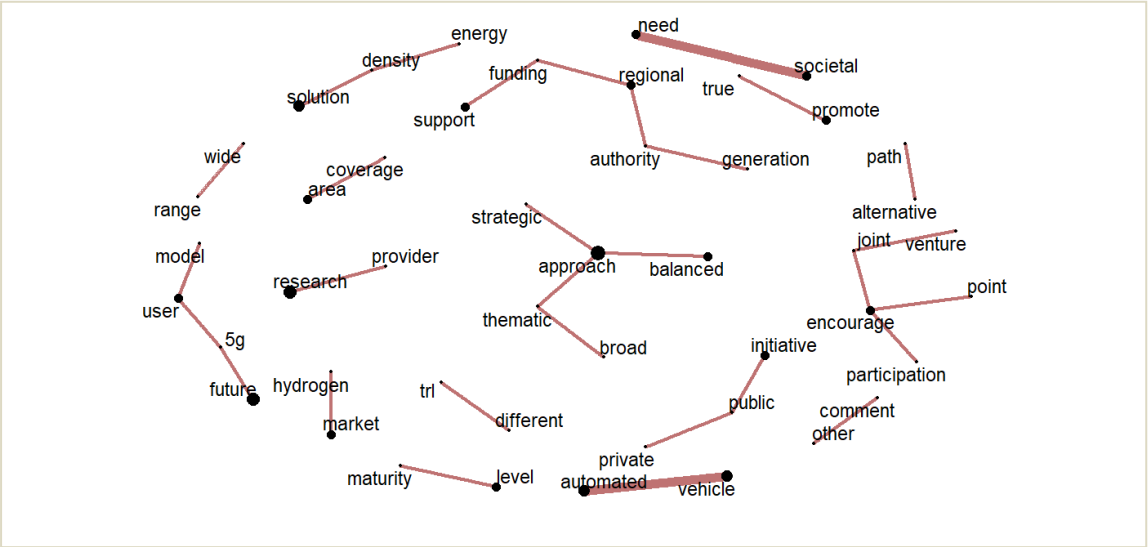
No statistical differences were found between the views of citizens and other respondents. Respondents that are/were involved in a current/preceding partnership (Horizon 2020 or Framework Programme 7) found the need regarding EU policy objectives more relevant than other respondents.

Figure 40: Views of the respondents in regard to the needs of future European Partnerships under Horizon Europe (N=102)



The respondents also had the option to indicate other needs. The results of the analysis resulted in the chart shown in Figure 41 showing the co-occurrences of keywords. The results show that respondents have indicated needs around a balanced and strategic approach as well as societal needs.

Figure 41: Assessment of open answers of other needs, 50 most common co-occurring keywords (N=45)



A large proportion of academic/research institutions that responded felt that a future Partnership would need to be inclusive of and promote collaboration between all types of research actors and European Regions. Along the same lines, one academic/research institution interviewee noted that a partnership (and its calls) must be open to avoid widening research and knowledge divide across Europe.

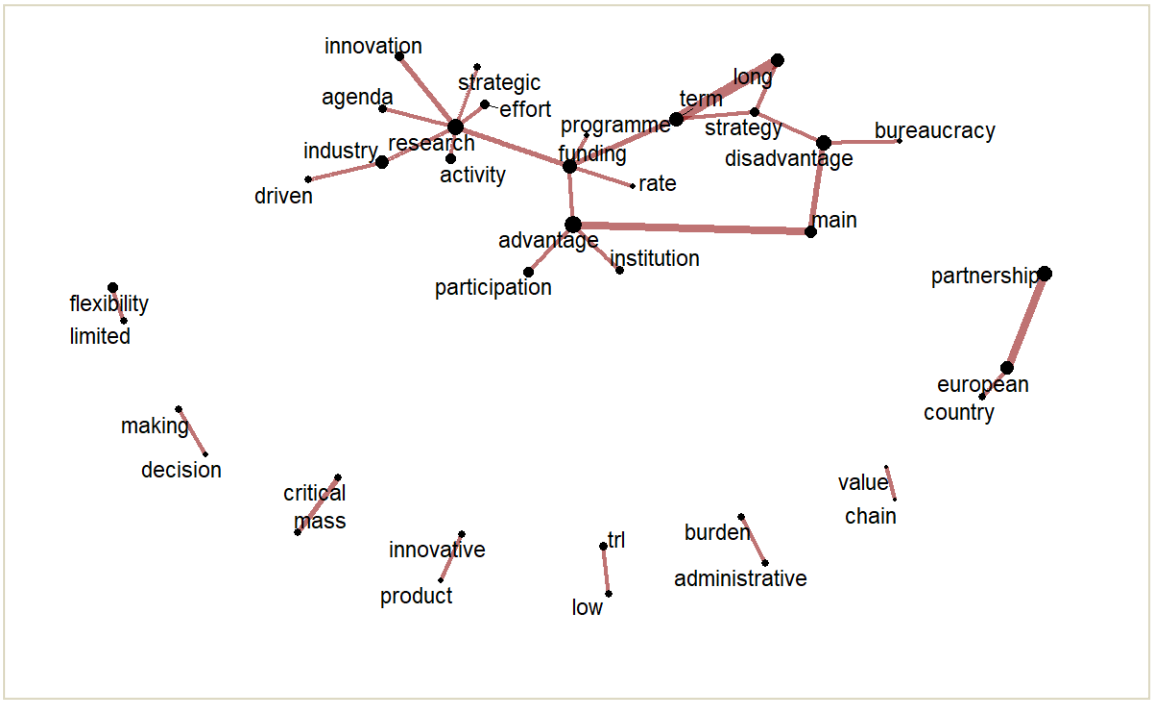
With regards to scope, one academic/research institution interviewee felt that a broad thematic approach should be maintained to avoid lack of innovation in alternative paths. Similarly, one consumer organisation and another academic/research institution felt a Partnership would need a technology neutral/balanced approach, where projects are chosen according to quality of application and innovative potential across all maturity levels (TRLs), rather than policy priorities. One company/business organisation felt more could be done to promote projects for the safe introduction and integration of automated vehicles.

More generally, one EU citizen felt a Partnership would need to look ahead to forthcoming technologies, applications and methodologies. One academic/research institution interviewee felt a Partnership would need to adopt a more strategic approach to the R&D agenda, so that there is a joined up programme of work.

B.6.4 Main advantages and disadvantages of Institutionalised European Partnerships

The respondents were asked what they perceived to be the main advantages and disadvantages of participation in an Institutionalised European Partnership (as a partner) under Horizon Europe. The keyword analysis used for open questions resulted in the graph shown in Figure 42. This analysis showed the respondents viewed bureaucracy as a disadvantage. While they viewed programme funding and research as an advantage.

Figure 42: Assessment of open answers with advantages and disadvantages of participation in an Institutionalised European Partnership, 30 most common co-occurring keywords (N=78)



The identified advantages and disadvantages are summarised in Table 34 along with the number of times they were mentioned and the types of stakeholders that mentioned them.

Table 34: Summary of main advantages and disadvantages of European IP

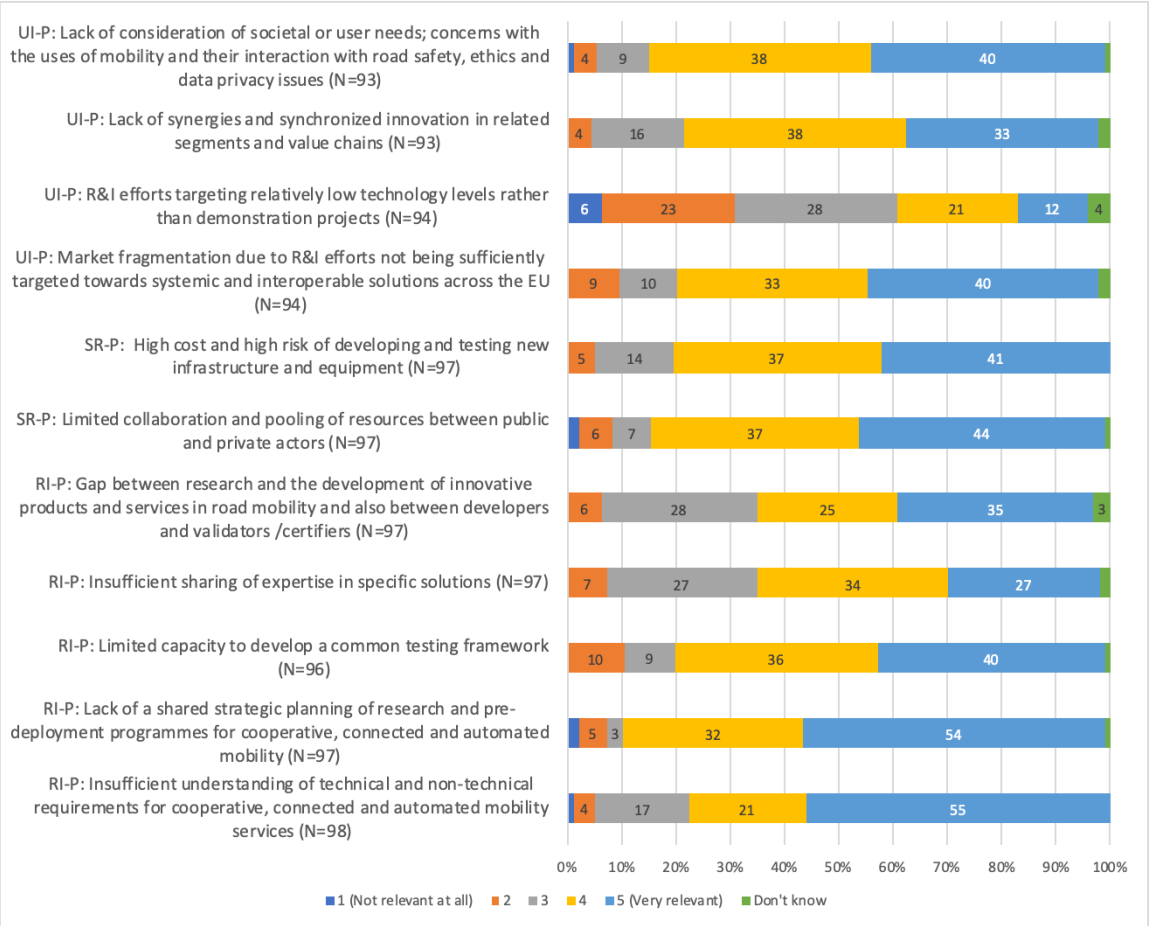
		Stakeholder	
		#	Type
Advantages	Strengthened relations and cooperation between stakeholders (EU countries, industry, research organisations)	4	• EU citizen • Company/business organisation • Business association • Other
	Improved access to funding	2	• Business association • Other
	Knowledge on specific topic and field of activity in one place	1	• Other
	More efficient	1	• EU citizen
	Allows sharing of technological road maps	1	• Company/business organisation
	Strategic direction and research agenda	1	• Company/business organisation
	Able to influence/input into decisions	1	• Company/business organisation
	Will shape ecosystem of large companies, SMEs, universities and institutes	1	• Company/business organisation

		Stakeholder	
		#	Type
Disadvantages	Risk of excluding some stakeholders (incl. countries in which relevant industries are not mature)	2	• Other • Non-EU citizen
	Administrative costs	2	• Company/business organisation • Non-governmental organisation (NGO)
	Risk of creating ecosystem consisting of silos	1	• Other
	Would involve fewer partners which would lead to reduction in intra-European competition	1	• EU citizen
	Institutions define goals independently without involving companies	1	• Company/business organisation
	Lower funding rate compared to regular calls	1	• Company/business organisation
	Multiple reporting on activities and costs	1	• Company/business organisation
	Complex governance and decision making	1	• Company/business organisation
	Limitations relating to flexibility, efficiency and timeliness of actions	1	• Business association

B.6.5 Relevance of EU level efforts to address problems in relation to the Safe and Automated Road Transport initiative

In the consultation, respondents were asked to provide their view on the relevancy of research and innovation efforts at EU level to address the following problems in relation road transport, specifically on three types of problems: problems in uptake of road transport innovations (UI-P), structural and resource problems (SR-P) and research and innovations problems (RI-P). In Figure 43, the responses to these answers are presented.

Figure 43: Views of respondents on relevance of research and innovation efforts at the EU level to address problems in relation to road transport



With regard to the uptake in innovation problems, 40 respondents have indicated that the research and innovation efforts at the EU level to address the issue of lack of consideration of societal or user needs, concerns with the uses of mobility and their interaction with road safety, ethics and data privacy issues are very relevant (43.01%). The same number of respondents has indicated that market fragmentation due to R&I efforts not being sufficiently targeted towards systemic and interoperable solutions across the EU is very relevant (42.55%). This category of problems also has the problem that is indicated as very relevant the least, only 12 times (12.77%). This problem is the R&I effort targeting relatively low technology levels rather than demonstration projects.

There are only two structural and resource problems that the respondents were asked to reflect on. Respondents gave similar answers in regard to both, with the limited collaboration and pooling of resources between public and private actors, being indicated as very relevant just slightly more often (44, 45.36%).

Of the research and innovation problems, there are two that were perceived as the most relevant. The lack of a shared strategic planning of research and pre-deployment programmes for cooperative, connected and automated mobility (54, 55.67%) and insufficient understanding of technical and non-technical requirements for cooperative, connected and automated mobility services (55, 56.12%) have been indicated as very relevant most often.

No statistical differences were found between the views of citizens and other respondents for most problems. Citizens found the uptake in innovation problem related to R&I efforts targeting relatively low technology levels more relevant. Respondents that are/were involved in a current/preceding partnership (Horizon 2020 or Framework Programme 7) found the research and innovation problem related to the gap between research and the

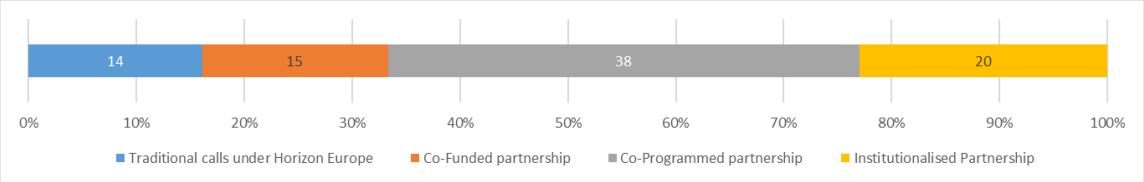
development of innovation as well as the structural and resource problem regarding new infrastructure and equipment more relevant.

B.6.6 Horizon Europe mode of intervention to address problems

After providing their views on the relevance of problems, respondents were asked to indicate how these challenges could be addressed through Horizon Europe intervention. As shown in Figure 44, just over 20% of respondents indicated that institutionalised partnerships were the best fitting intervention.

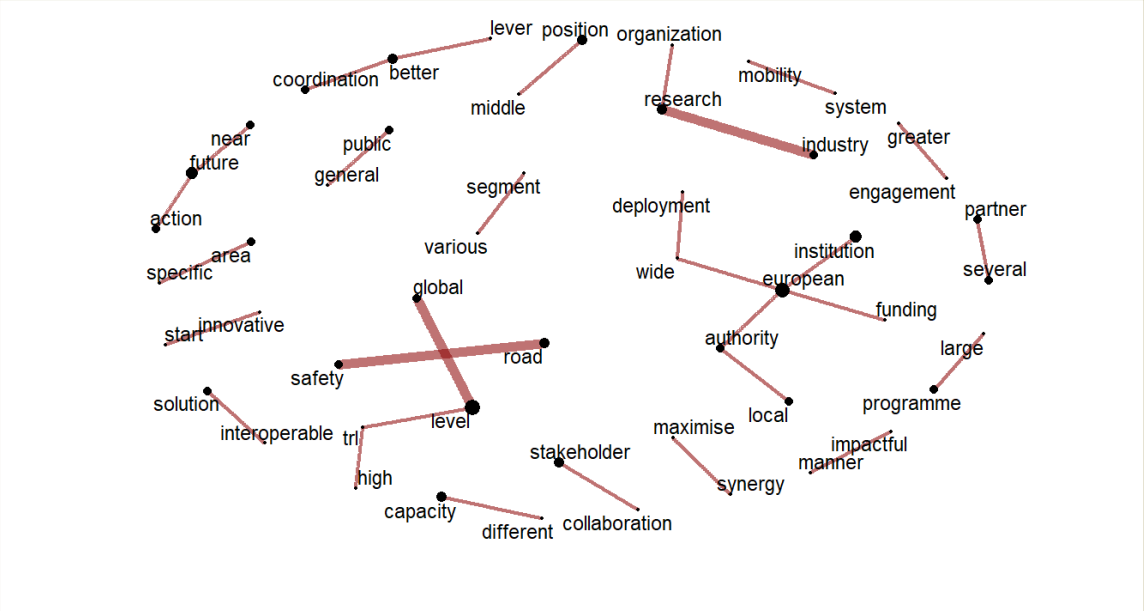
No statistical differences were found between the views of citizens and other respondents.

Figure 44: Assessment of Horizon Europe intervention



The respondents were asked to briefly explain their answers to the question above. People who stated that an institutionalised partnerships was the best fitting answer, mentioned industry research, European funding and better coordination (Figure 45). Respondents who did not select institutionalised partnership as their preferred intervention (N=49) traditional calls, coordination with European partnerships and administrative burden (not pictured).

Figure 45: Assessment of open answers to explain their choice institutionalised partnership in the assessment of the Horizon Europe intervention, 30 most common co-occurring keywords (N=16)



One interviewee from an academic/research institution felt that the subject must be guided by a wide range of stakeholders, not a core group of industrial players. Responses from company/business organisations included that stronger involvement of Member States can make the process more efficient and that topics need to be considered with respect to the business case and human factors. One business association interviewee answered that the best way to gain committed participation is with certainty of financial support.

Views on SMEs varied with one interviewee from a company/business organisation stating that traditional calls need to be replaced as the number of successful proposals by SMEs is falling. One interviewee from an academic/research institution felt that traditional calls give

the best opportunity for SMEs to provide output, another felt that larger partnerships favour those that can afford to buy-in, reducing accessibility for SMEs. They went on to state that despite the instrument used, open calls for all topics and actors should be guaranteed.

Some interviewees responded with their preferred partnership option and its desired characteristics. One interviewee from an academic/research institution felt that traditional calls are preferred due to the flexibility and ability to include all modes. Two interviewees (business association and public authority) expressed a preference for a Co-Programmed Partnership. One reason for this, mentioned by both interviewees, was that guaranteed cooperation between communities (public) and industries is needed. The public authority interviewee felt that a systematic approach that gives some predictability in the long term but also allows sufficient flexibility (incl. involvement of new partners) is needed. The business association interviewee also felt this is needed and proposed that establishing a memoranda of understanding would permit a versatile structure. The business association interviewee also felt there is a need to increase intensity and relevance of R&I initiatives. One non-EU citizen interviewee suggested a structure similar to that of the European Green Vehicle Initiative.

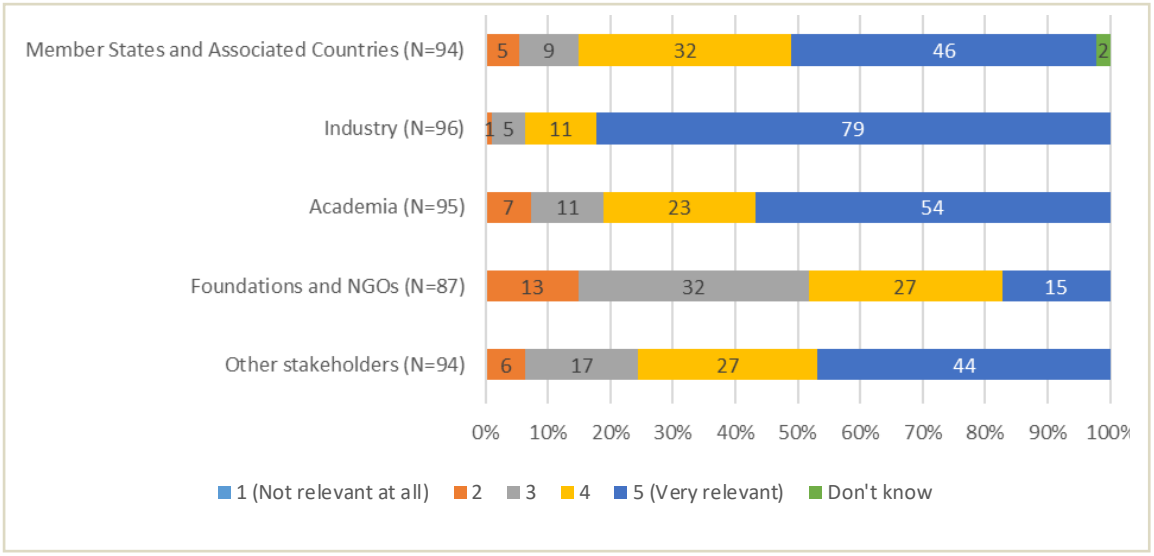
B.6.7 Relevance of a set of elements and activities to ensure that the proposed European Partnership would meet its objectives

Setting joint long-term agendas

Respondents were asked how relevant the involvement of actors is in setting a joint long-term agenda to ensure that the proposed European Partnership would meet its objectives (see Figure 46). The highest amount of respondents indicated that the involvement of industry is very relevant (79 respondents or 82.29%). A large part of respondents also indicated that the involvement of academia (54, 46.83%) is very relevant. The only categories where less than 50% of respondents indicated that involvement was very relevant, were other stakeholders (44 respondents, 46.81%) and foundations and NGO's (15, 17.24%). Foundations and NGO's are the only category where more respondents indicated a 3 or lower than a 4 or higher.

No statistical differences were found between the views of citizens and other respondents.

Figure 46: Views of respondents on relevance of actors in setting joint long-term agenda

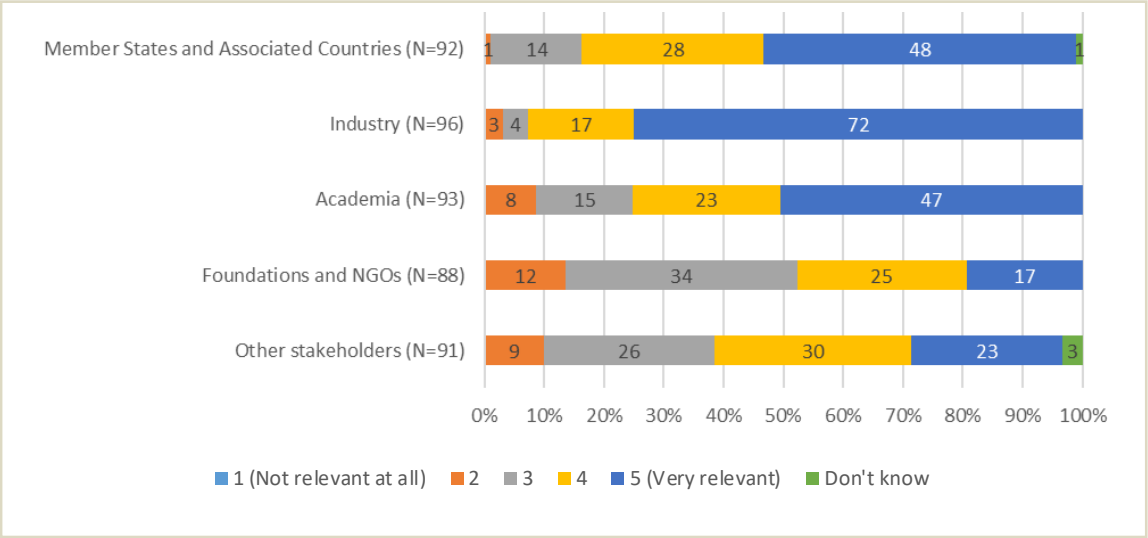


Relevance of elements and activities in pooling and leveraging resources

With respect to the relevance of actors in pooling and leveraging resources, such as financial, infrastructure, in-kind expertise etc.), to meet partnership objectives, the patterns are very similar. A total of 72 respondents (78.26%) indicated that industry was very relevant, and 48 (57.14%) respondents felt that Member States and Associated Countries were very relevant. With regard to academia 48 respondents (51.61%) felt that they were very relevant. Also, similar to the previous question, foundations and NGO's were seen as less relevant, as they are the only category where more respondents indicated a 3 or lower than a 4 or higher. No respondents indicated that any of the categories was Not relevant at all.

No statistical differences were found between the views of citizens and other respondents. Respondents that are/were involved in a current/preceding partnership found most stakeholders more relevant.

Figure 47: Views of respondents on relevance of actors for pooling and leveraging resources

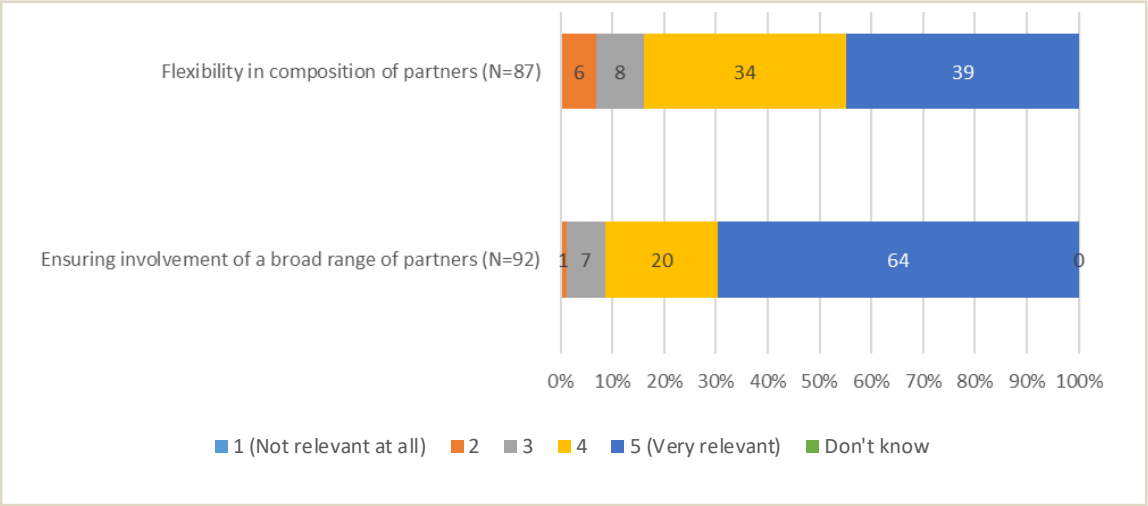


Relevance of elements and activities for the partnership composition

Respondents were asked about the relevance of Partnership composition, such as flexibility in the composition of partners over time and involvement of a broad range of partners (including across disciplines and sectors), to reach Partnership objectives. As it is visible in Figure 48, ensuring involvement of a broad range of partners has more 'very relevant' answers (64, 69.57%) than the flexibility in the composition of partners (39, 44.83%). Overall 83.91% of respondents have given flexibility either a score of 4 or 5 (very relevant), while 91.30% have given the broad range of partners a score of 4 or 5 (very relevant).

No statistical differences were found between the views of citizens and other respondents.

Figure 48: Views of respondents on relevance of partnership composition elements

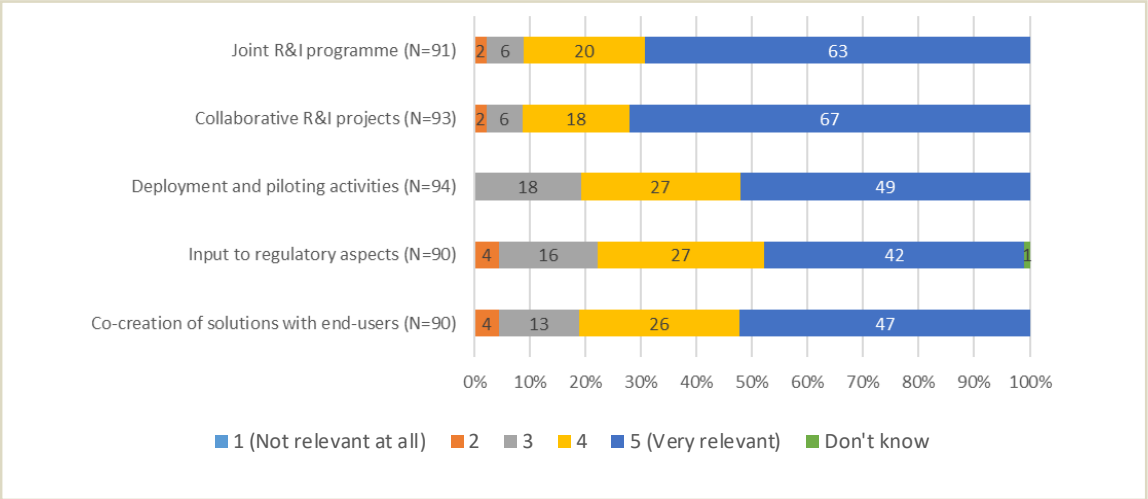


Relevance of implementation of activities

Respondents were asked to provide opinions on relevance of implementation of several activities for meeting objectives of the Safe and Automated Road Transport Partnership. Among activities were listed – a joint R&D programme, collaborative R&D projects, deployment and piloting activities, input to regulatory aspects and co-creation of solutions with end-users. Out of 93 respondents, 67 (71.28%) indicated that collaborative R&I projects are very relevant to ensure that the Partnership would meet its objectives. A Joint R&I programme has also been considered as very relevant by a large number of respondents (63 respondents or 69.23%). For the other activities, around half of respondents have indicated that these are very relevant.

No statistical differences were found between the views of citizens and other respondents for most activities. Citizens found the co-creation of solutions with end-users more relevant.

Figure 49: Views of respondents on relevance of implementation of the following activities



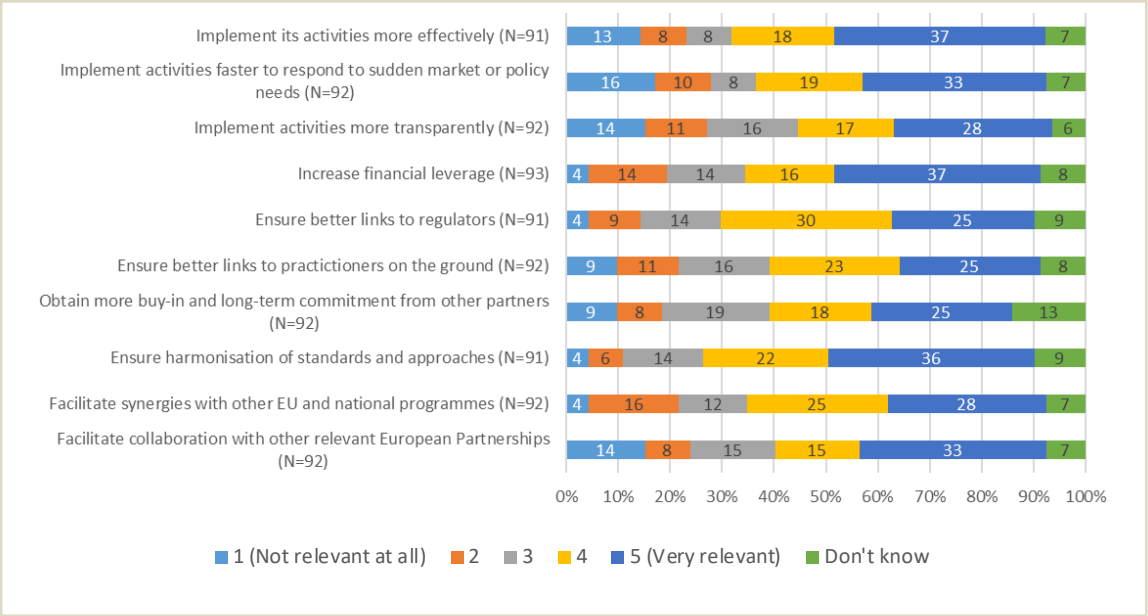
B.6.8 Relevance of setting up a legal structure (funding body) for the candidate European Partnerships to achieve improvements

Respondents were also asked to assess the relevance of a specific legal structure (funding body) for the candidate European Partnership to achieve several activities. According to Figure 50, the differences across the different categories are not incredibly large. For all but one measure (Implement activities more transparently), over 50% of respondents

have selected either 4 or 5 (very relevant) for all the categories. The most respondents indicated that a specific legal structure was 'very relevant' to implement its activities more effectively (37 respondents, 40.66%) and to increase financial leverage (37, 39.78%). The number of respondents that have indicated that they view a measure as 'not relevant at all' is very small across all the measures.

No statistical differences were found between the views of citizens and other respondents for most objectives. Citizens found the legal structure more relevant for objectives regarding regulators and synergies with other programmes. Respondents that are/were involved in a current/preceding partnership found the legal structure more relevant for the objective regarding better links to practitioners on the ground.

Figure 50: Views of respondents on relevance of a specific legal structure

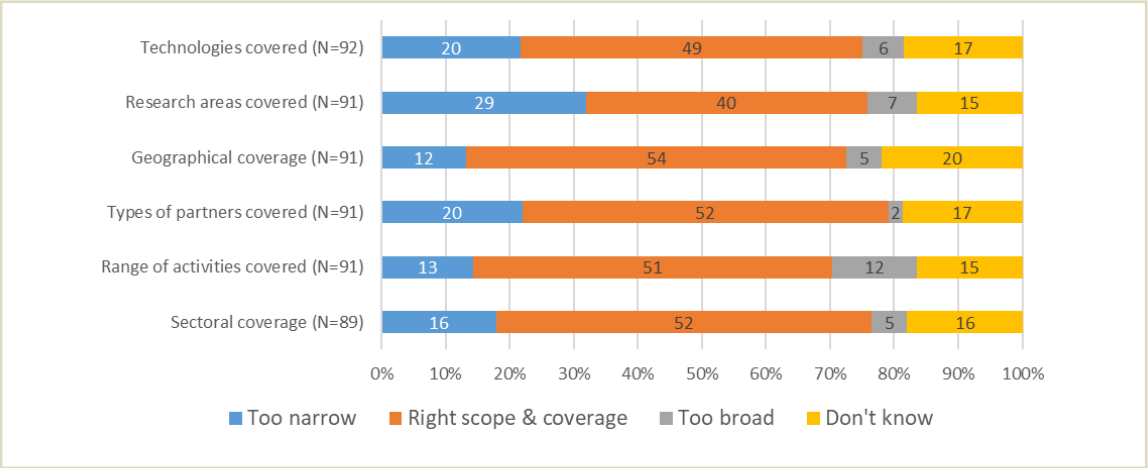


B.6.9 Scope and coverage of the candidate European Partnerships based on their inception impact assessments

Respondents were asked to assess the scope and coverage of the Safe and Automated Road Transport Partnership, based on its inception impact assessment. The clear majority of the respondents have indicated that the partnership has the right scope and coverage across all areas. Research areas covered is the only category where less than 50% of respondents (40, 43.96%) have indicated that the scope and coverage are right. A total of 29 respondents (31.87%) have indicated that the scope and coverage of these research areas is too narrow.

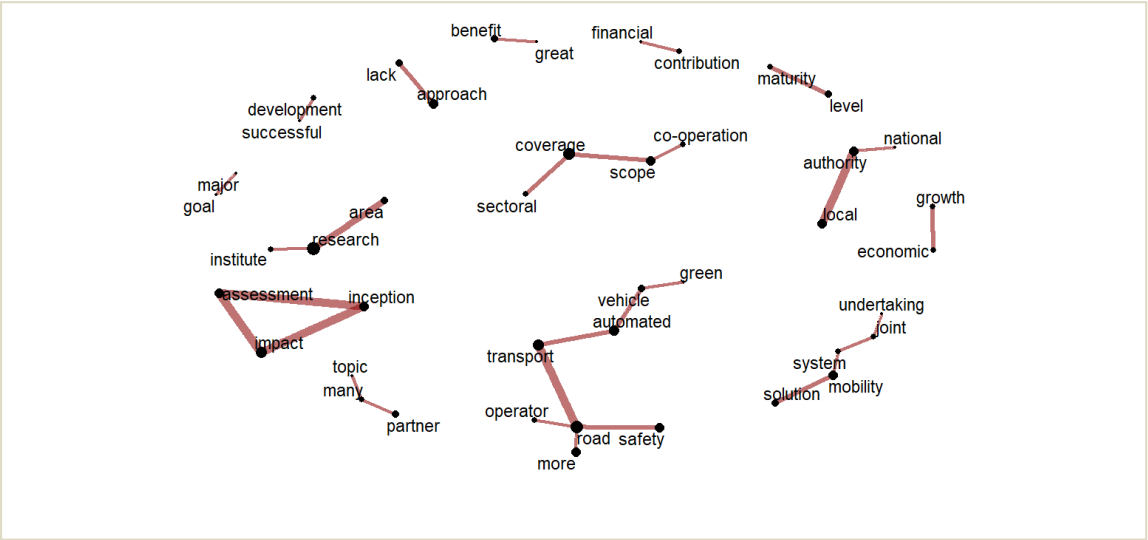
No statistical differences were found between the views of citizens and other respondents.

Figure 51: Views of respondents on the scope and coverage proposed for the Safe and Automated Road Transport Partnership



Aside from this multiple choice question, the respondents were also asked to provide any comment that they may have on the proposed scope and coverage for this candidate Institutionalised Partnership. The keyword analysis used for open questions resulted in the graph shown in Figure 52. This analysis showed the respondents used this question to talk about impact assessment at the inception, road safety in transport related to automated vehicles and sectoral coverage.

Figure 52: Assessment of open answers with regard to the proposed scope and coverage for this candidate Institutionalised Partnership, 30 most common co-occurring keywords (N=28)



In terms of subject, one business association interviewee felt attention needs to be given to opportunities stemming from data in the transport sector. The importance of taking into account the early stages of CAVs and the transition period in a mixed traffic environment was highlighted by a non-governmental organisation (NGO) interviewee. One interviewee from a company/business organisation felt that many of the topics should be covered in the scope of more than one initiative.

With respect to other modes of transport, one business association interviewee felt that the 'road transport' scope is appropriate as road safety is a top priority, while an academic/research institution interviewee felt more interfaces to the other automated transport modes are necessary.

One business association interviewee highlighted a need for a joint effort in order to harness the benefits of CCAM. An academic/research institution interviewee more

specifically stated that research institutes and universities should be mentioned as key partners, as well as local authorities.

Two interviewees, a company/business organisation interviewee and non-EU citizen, answered that there was not enough information given about scope and coverage to comment on.

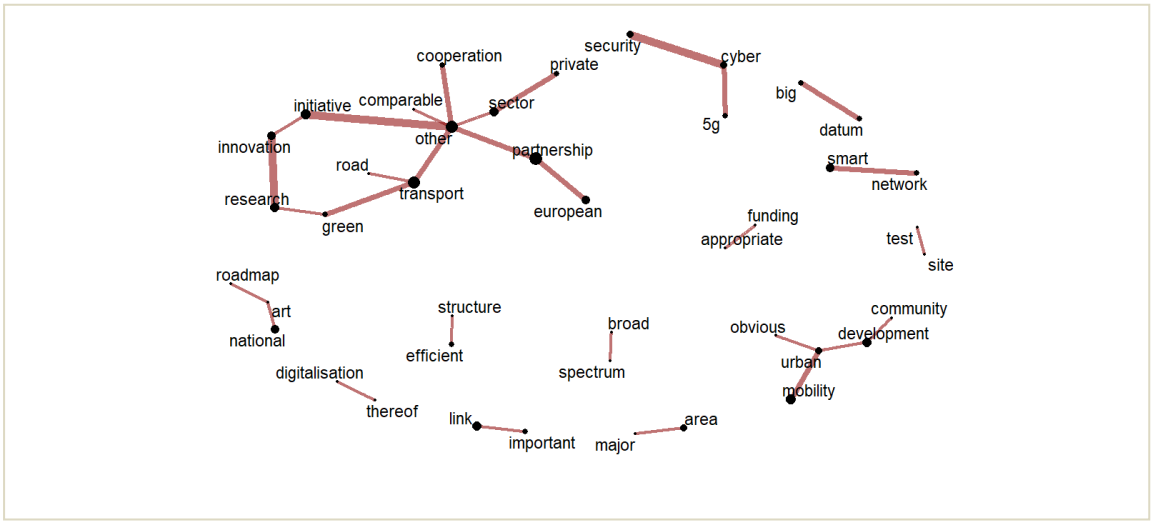
B.6.10 Scope for rationalisation and alignment of candidate European Partnerships with other initiatives

The respondents were also asked if it they thought it would be possible to rationalise the candidate European Institutionalised Partnership and its activities, and/or to better link it with other comparable initiatives. A total of 57 respondents (67.86%) have indicated that they think this is the case.

No statistical differences were found between the views of citizens and other respondents.

The respondents who answered affirmative, where asked which other comparable initiatives it could be linked with. The results of the analysis resulted in the chart shown in Figure 53 showing the co-occurrences of keywords. The results show that respondents think the initiative could be linked with other comparable cooperation, green road transport, urban mobility and cyber security related to 5G.

Figure 53: Assessment of open answers on the question on which other comparable initiatives it could be linked with, 30 most common co-occurring keywords (N=27)



Comparable initiatives that interviewees felt the Partnership could be linked with are summarised in Table 35 along with the number of times they were mentioned and the types of stakeholders that mentioned them.

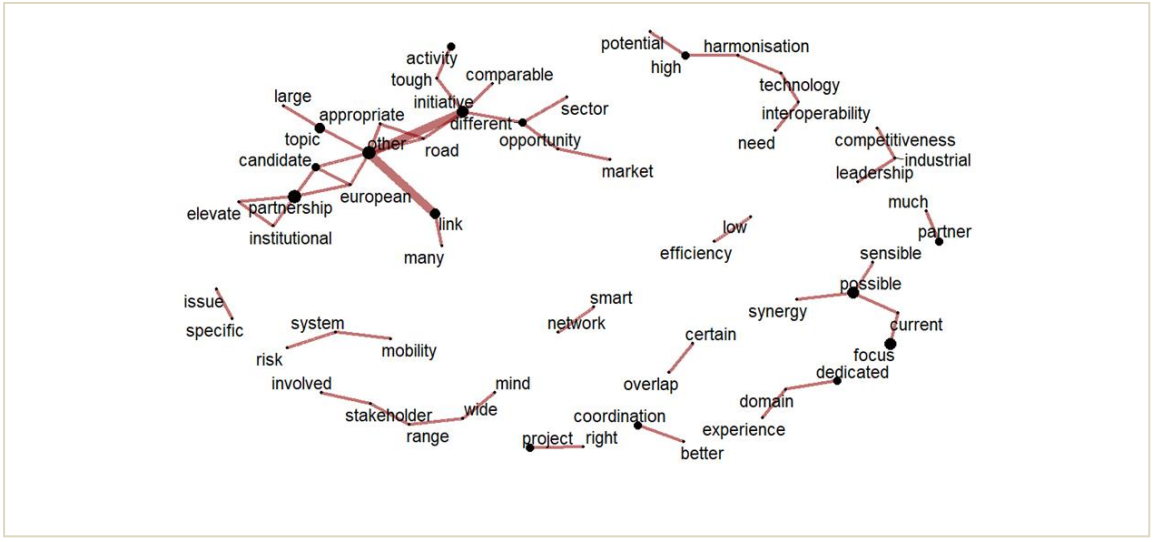
Table 35: Comparable initiatives to which Partnership could be linked

		Stakeholder	
		#	Type
Other Transport	Potential new partnership on smart and green waterborne transport	1	Public authority
	Freight	1	Public authority
Mobility	Urban mobility (e.g. CIVITAS, EIT urban mobility, UDN)	1	Other

		Stakeholder	
		#	Type
	Smart Specialisation Partnerships (e.g. S3P Safe and Sustainable Mobiliity)	1	Other
	City logistics	1	Public authority
Communications / Connectivity	Cyber security	2	Company/business organisation Public authority
	Smart Networks	1	Business association
	Telecommunication	1	Company/business organisation
	Mobile connectivity and 5G	1	Public authority
In-vehicle Technology	Machine vision (safety and object detection)	1	Public authority
Other	Retrofitting existing vehicles	1	Public authority

For the respondents who answered negatively on the previous question, the results of the analysis resulted in the chart shown in Figure 54 showing the co-occurrences of keywords. The results show that respondents think it would be tough to find comparable initiatives and that there might be overlap.

Figure 54: Assessment of open answers on the question why other comparable initiatives are not suitable to be linked, 30 most common co-occurring keywords (N=15)



One interviewee from a company/business organisation felt the Partnership shouldn't be linked with comparable initiatives as the proposed scope is just right. Two interviewees, one from a company/business organisation and one from a business association, felt if there are too many links with other initiatives focus will be lost. The same interviewee from a business association and an interviewee from another company/business organisation felt that cooperation, rather than links, should be explored.

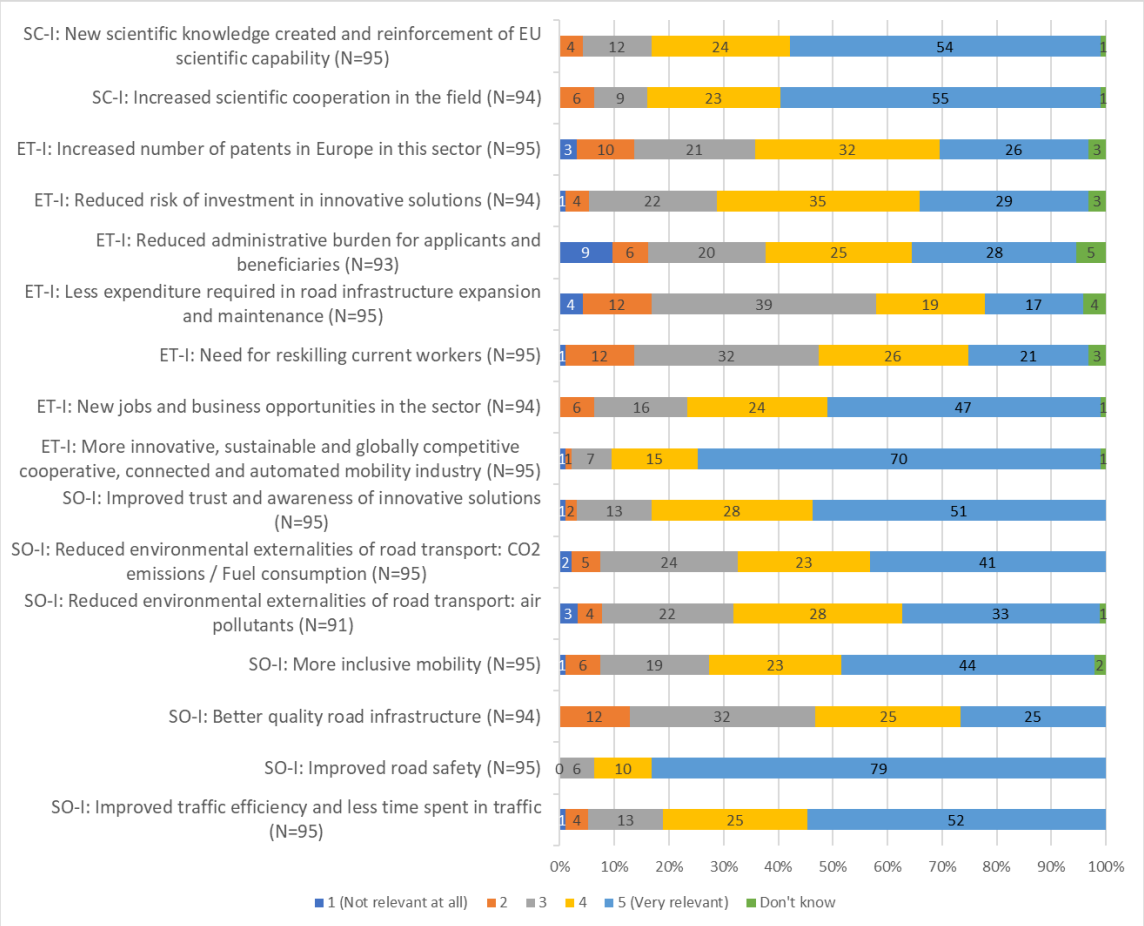
Although not completely against linking with other initiatives, one interviewee from a company/business organisation felt that the connections should be handled autonomously by the Partnership. Coordination with the activities of CEF was recommended by another company/business organisation interviewee.

B.6.11 Relevance of European Partnerships to deliver targeted scientific, economic/technological and societal impacts

Respondents were asked to assess the relevance of the candidate European Institutionalised Partnership to deliver on listed impacts. Figure 55 depicts that a considerably higher number of respondents think that among listed societal impacts the Partnership is expected to be 'very relevant' for improving road safety. In contrast, the lowest number of respondents, namely 25 out of 94 (26.60%), believe that the partnership will lead to better quality road infrastructure. Among presented economic/technological impacts, the greater number of respondents (70 out of 95, or 73.68%) suggest that the partnership would be 'very relevant' for making more innovative, sustainable and globally competitive, cooperative, connected and automated mobility industry. Other categories of economic/technological impacts reflect a great diversity of views among respondents and lower average score. In view of respondents, the partnership is less likely to be relevant for reducing expenditure required in road infrastructure expansion and maintenance and in responding to need for reskilling current workers. With respect to assessment of the relevance of the partnership for the impact categories in the area of science, the average score are relatively high, as around 60% of respondents consider that the partnership would be 'very relevant' for generating new scientific knowledge and for increasing scientific cooperation in the field.

No statistical differences were found between the views of citizens and other respondents.

Figure 55: Views of respondents on the relevance of the candidate European Institutionalised Partnership to various impacts



Appendix C Methodological Annex

The Impact Assessment studies for all 13 candidate institutionalised European Partnerships mobilised a mix of qualitative and quantitative data collection and analysis methods. These methods range from desk research and interviews to the analysis of the responses to the Open Consultation, stakeholder analysis and composition/portfolio analysis, bibliometrics/patent analysis and social network analysis, and a cost-effectiveness analysis.

The first step in the impact assessment studies consisted in the definition of the context and the problems that the candidate partnerships are expected to solve in the medium term or long run. The main data source in this respect was desk research. The Impact Assessment Study Teams went through grey and academic literature to identify the main challenges in the scientific and technologic fields and in the economic sectors relevant for their candidate partnerships. The review of official documentations, especially from the European Commission, additionally helped understand the main EU policy proprieties that the initiatives under assessment could contribute to achieve.

Almost no candidate institutionalised European Partnership is intended to emerge ex nihilo. Partnerships already existed under Horizon 2020 and will precede those proposed by the European Commission. In the assessment of the problems to address, the Impact Assessment Study Teams therefore considered the achievements of these ongoing partnerships, their challenges and the lessons that should be drawn for the future ones. For that purpose, they reviewed carefully the documents in relation to the preceding partnerships, especially their (midterm) evaluations conducted. The bibliography in Appendix A gives a comprehensive overview of the documents and literature reviewed for the present impact assessment study.

Finally, the description of the context of the candidate institutionalised European Partnerships required a good understanding of the corresponding research and innovation systems and their outputs already measured. The European Commission services and, where needed the ongoing Joint Undertakings or implementation bodies of the partnerships under Article 185 of the TFEU, provided data on the projects that they funded and their participants. These data served as basis for descriptive statistic of the numbers of projects and their respective levels of funding, the type of organisations participating (e.g. universities, RTOs, large enterprises, SMEs, public administrations, NGOs, etc.) and how the funding was distributed across them. Special attention was given to the countries (and groups of countries, such as EU, Associated Countries, EU13 or EU15) and to the industrial sectors, where relevant. The sectoral analysis required enriching the eCORDA data received from the European Commission services with sector information extracted from ORBIS. We used the NACE codification up to level 2. These data enabled identified the main and, where possible, emerging actors in the relevant systems, i.e. the organisations, countries and sectors that will need to be involved (further) in the future partnerships.

The horizontal teams also conducted a Social Network Analysis using the same data. It consisted in mapping the collaboration between the participants in the projects funded under the ongoing European partnerships. This analysis revealed which actors – broken down per type of stakeholders or per industrial sector – collaborate the most often together, and those that are therefore the most central to the relevant research and innovation systems.

The data provided by the European Commission finally served a bibliometric analysis aimed at measuring the outputs (patents and scientific publications) of the currently EU-funded research and innovation projects. A complementary analysis of the Scopus data enabled to determine the position and excellence of the European Union on the international scene, and identify who its main competitors are, and whether the European research and innovation is leading, following or lagging behind.

All together, these statistical analyses will complement the desk research for a comprehensive definition of the context in which the candidate institutionalised European Partnerships are intended to be implemented. The conclusions drawn on their basis will be confronted to the views of experts and stakeholders collected via three means:

- The comments to the inception impact assessments of the individual candidate institutionalised European partnerships received in August 2019
- The open public consultation organised by the European Commission from September to November 2019
- The interviews (up to 50) conducted by each impact assessment study team conducted between August 2019 and January 2020.

For instance, in all three exercises, the respondents were asked to reflect on the main challenges that the candidate institutionalised European Partnerships should address. In the open public consultations, they mainly reacted to proposals from the European Commission like when they were given to opportunity to give feedback to the inception impact assessment.

The views of stakeholders (and experts) were particularly important for determining the basic functionalities that the future partnerships need to demonstrate to achieve their objectives as well as their most anticipated scientific, economic and technological, and societal impacts. The interviews allowed more flexibility to ask the respondents to reflect about the different types of European Partnerships. Furthermore, as a method for targeted consultation, it was used to get insights from the actors that both the Study Teams and the European Commission were deemed the most relevant. For the comparative assessment of impacts, the Study Teams confronted the outcomes of the different stakeholder consultation exercises to each other with a view of increasing the validity of their conclusions, in line with the principles of triangulation. Appendix B includes also the main outcomes of these three stakeholder consultation exercises.

The comparison of different options for European partnerships additionally relied on a cost-effectiveness analysis. When it comes to research and innovation programmes, the identification of costs and benefits should primarily be aimed at identifying the "value for money" of devoting resources from the EU (and Member States) budget to specific initiatives. Based on desk research and consultation with the European Commission services, the horizontal study team produced financial estimates for different types of costs (preparation and setup costs, running costs and winding down costs) and per partnership option. The costs were common to all candidate European Partnerships. The results of the cost model were displayed in a table, where each cost was translated on a scale using "+" in order to ease the comparison between the partnership options.

A scorecard analysis, which allocated each option a score between 1 and 3 against selected variables, was used to highlight those options that stand out as not being dominated by any of the other options in the group: such options are then retained as the preferential ones in the remainder of our analysis. It also allowed for easy visualisation of the pros and cons of alternative options.

Appendix D Additional information on the policy context

D.1 Policy background

Under the Declaration of Amsterdam on cooperation in the field of CAD,[40] the European Commission was assigned a series of actions. These included to develop a shared European strategy on Connected and Autonomous Driving (CAD) (adopted in 2018 and summarised below), review and where necessary adapt the EU regulatory framework, and develop a coordinated approach (within Energy Union Research, Innovation and Competitiveness Strategy, EU and member states) towards research and innovation activities in the field of CAD.

The need for the first of these actions, a shared European strategy on CAD, is also stressed in the final report by GEAR 2030,[41] a high level group consisting of member state authorities and stakeholders representing industry, services, consumers, environmental protection and road safety. The report lists 32 recommendations to address the main challenges and opportunities for the sector in the run-up to 2030 and beyond. These recommendations include better cross-border coordination and exchange of lessons learnt during testing on subjects of public interest.

Under the Valetta Declaration (Transport ministers of the Member Sates of the European Union, 2017) on improving road safety, the EU member states called on the commission to 'explore the potential of connected and automated driving technologies' and 'ensure necessary resources are allocated to research, programmes and projects promoting road safety in Europe'.

'Europe on the Move' (European Commission, 2017) highlights the importance of the mobility sector on the EU economy and society and the need to lead in its transformation to a user-centric approach which is a result, partly, of new digital technologies both internal to the vehicle and external (e.g. smartphones). The 2018 'Europe on the Move' communication (European Commission, 2018), notes that safety must remain the top priority. While technological advances in automation are expected to create new opportunities to eliminate or compensate for human error and increase safety in the long term, it is noted that new risks are emerging in the transition phase relating to operation in mixed traffic, complex interaction between the driver and vehicle and cyber security issues. Other expected benefits such as wider access to mobility services, and improvements in traffic congestion and efficiency, are referenced although these are associated more with the connected and cooperative parts of CCAM.

In the 'On the road to automated mobility: An EU strategy for mobility of the future',[42] the Commission proposes an approach towards connected and automated mobility. The agenda provides a common vision and identifies supporting actions for technical development (including services and infrastructure), legal and policy frameworks and public acceptance (societal and environmental concerns). In terms of legislation, the EU has combined vehicle approval rules with market surveillance to establish a new approach for certifying the safety of automated vehicles which is less design specific and more

[40] European Commission, "Declaration of Amsterdam - Cooperation in the field of connected and automated driving," 15 April 2016. [Online]. Available: https://www.regjeringen.no/contentassets/ba7ab6e2a0e14e39baa77f5b76f59d14/2016-04-08-declaration-of-amsterdam---final1400661.pdf. [Accessed 20 September 2019].

[41] GEAR 2030, "Final Report of High Level Group on the Competitiveness and Sustainable Growth of the Automotive Industry in the EU," 18 October 2017. [Online]. Available: https://ec.europa.eu/growth/content/high-level-group-gear-2030-report-on-automotive-competitiveness-and-sustainability_en. [Accessed 20 September 2019].

[42] European Commission, *On the road to automated mobility: An EU strategy for mobility of the future,* Brussels: COM(2018) 283 final, 2018.

adapted to their evolutionary nature (European Commission, 2019). While this allows the vehicle to be placed on the EU market, to ensure mutual recognition of national ad-hoc safety assessments, it is important that Member States follow a common approach to vehicle certification and approval.

'On the road to automated mobility: An EU strategy for mobility of the future'[43] also states that while a connected vehicle does not have to be automated and an automated vehicle does not necessarily have to be connected, connectivity is expected to be a major enabler for driverless vehicles in the medium term. Some studies have quantitatively shown that automation without connectivity could lead to a potential deterioration of traffic conditions due to AVs' being unable to predict neighbouring vehicle's movements and take risks.[44]

The C-ITS (Cooperative Intelligent Transport System) Deployment Platform has allowed the Commission to take a more prominent role in the deployment of connected driving. In their 2016 report,[45] the Platform defines C-ITS as 'systems that use technologies that allow road vehicles to communicate with other vehicles, with traffic signals and roadside infrastructure as well as with other road users. The systems are also known as vehicle-to-vehicle communications, or vehicle-to-infrastructure communications. The Day 1 and Day 1.5 C-ITS priority services that are expected to contribute most to safety and efficiency while being achievable in the short term are also defined in this report. In their 2017 report,[46] the Platform lists fifteen recommendations which include to 'foster cooperation between the different players and enable coopetition for the development of the common tools and building blocks', 'start piloting… in the comprehensive Ten-T Road Network, including urban nodes. Road authorities/operators should be in charge' and 'make available funding instruments (CEF, H2020) taking into account the research and piloting recommendations'.

According to the 'European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility' (European Commission, 2016), C-ITS can contribute to improving road safety, increasing the efficiency of road transport, and ensuring the competitiveness of EU industry. The document sets out recommended actions and confirms the Day 1 and Day 1.5 C-ITS services as those in Table 36. The commission will support the deployment of Day 1 services, notably through the Connecting Europe Facility (CEF), European Structural and Investment Funds and the European Fund for Strategic Investments. The Commission also committed to provide funding for research and innovation through H2020, and possibly the European Structural & Investment Funds, for Day 1.5 C-ITS services and beyond, including higher levels of automation.

[43] European Commission, *On the road to automated mobility: An EU strategy for mobility of the future,* Brussels: COM(2018) 283 final, 2018.

[44] M. e. al, "Connected and Automated Vehicles on a freeway scenario. Effect on traffic congestion and network capacity," 04 2018. [Online]. Available: https://ec.europa.eu/jrc/sites/jrcsh/files/connected-automated-vehicles-traffic-congestion-network-capacity_111621.pdf. [Accessed 23 01 2020].

[45] C-ITS Platform, "Final Report," January 2016. [Online]. Available: https://ec.europa.eu/transport/sites/transport/files/themes/its/doc/c-its-platform-final-report-january-2016.pdf. [Accessed 28 10 2019].

[46] C-ITS Platform, "Final Report," 2017. [Online]. Available: https://ec.europa.eu/transport/sites/transport/files/2017-09-c-its-platform-final-report.pdf. [Accessed 28 10 2019].

Table 36: C-ITS Priority Services

Day 1 C-ITS Services		Day 1.5 C-ITS Services
Hazardous Location Notifications: Slow or stationary vehicle(s) & traffic ahead warning; Road works warning; Weather conditions; Emergency brake light; Emergency vehicle approaching; Other hazards.	Signage Applications: In-vehicle signage; In-vehicle speed limits; Signal violation / intersection safety; Traffic signal priority request by designated vehicles; Green light optimal speed advisory; Probe vehicle data; Shockwave damping (falls under European Telecommunication Standards Institute (ETSI) category 'local hazard warning').	Information on fuelling & charging stations for alternative fuel vehicles; Vulnerable road user protection; On street parking management & information; Off street parking information; Park & ride information; Connected & cooperative navigation into and out of the city (first and last mile, parking, route advice, coordinated traffic lights); Traffic information & smart routing

The Climate, Energy and Mobility cluster aims to fight climate change, while improving the competitiveness of the transport industry as well as its services.[47] 'A Clean Planet for all'[48] highlights 'Embrace clean, safe and connected mobility' and 'Infrastructure and connections' as pathways for the transition to a net-zero greenhouse gas emissions economy. Under the first pathway, the need for efficient organisation of the mobility system in order to reduce congestion and increase occupancy rates is highlighted. Under the second pathway, aspects that are expected to rely on accelerated infrastructure development include digitalisation and smart charging, which are of particular relevance to CCAM.

Vision Zero is of particular relevance to and a driving force behind CCAM. According to the commission staff working document, 'EU Road Safety Policy Framework 2021-2030 – Next steps towards "Vision Zero",[49] it is unlikely that the EU will reach their medium-term target of half the number of road deaths between 2010 and 2020, the long-term target of close to zero deaths by 2050 is even more ambitious. Progress in reducing road fatality rates has stagnated in recent years, but 'some technological advances, first and foremost in connectivity and automation, will in future create new road safety opportunities by reducing the role of human errors'.[60]

Under the 'sustainable cities and communities' SDG goal, the subcategory of people killed in road accidents also shows insufficient progress towards the EU target set out in Vision Zero.

[47] European Commission, "Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe - Co-design via web open consultation," 2019. [Online]. Available: https://ec.europa.eu/research/pdf/horizon-europe/ec_rtd_orientations-towards-the-strategic-planning.pdf. [Accessed 14 10 2019].

[48] European Commission, "A Clean Planet for all - A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM (2018) 773 final)," 28 November 2018. [Online]. Available: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0773&from=EN. [Accessed 14 October 2019].

[49] European Commission, "EU Road Safety Policy Framework 2021-2030 - Next steps towards "Vision Zero"," 19 June 2019. [Online]. Available: https://ec.europa.eu/transport/sites/transport/files/legislation/swd20190283-roadsafety-vision-zero.pdf. [Accessed 20 September 2019].

D.2 Roadmaps

Three key roadmaps for automated driving from the last two years are listed and summarised below:

- (Visualisation of) European Roadmap for Connected and Automated Driving
- by SCOUT (Safe and Connected Automation in Road Transport)

The Scout roadmap[50] (released 18.09.2018) was funded under H2020 and defines use-case specific roadmaps for automated on-demand shuttles, truck platooning, automated valet parking, delivery robots and traffic jam chauffeurs. For each, a social, economic, human factors, legal and technical layer are considered, and challenges and opportunities are identified for each individual layer of each individual service. Once these are established, the milestones, goals and a plan of how to reach them are summarised.

- Connected Automated Driving Roadmap by ERTRAC (European Road Transport Research Advisory Council)

ERTRAC's roadmap[51] (released 08.03.2019) summarises common definitions, development paths (passenger, freight and urban), EU and international initiatives and key challenges and objectives. These include societal acceptance, ethics, human factors, environment, safety, services, data, policy/regulatory needs and a socio-economic assessment.

Note: ERTRAC have also released a *Safe Road Transport Roadmap (Towards Vision Zero: Roads without Victims)*[52] (released 28.02.2019) which has a strong focus on automated transport and its potential to reduce road accidents through removal of human error. Some of the research areas identified under this roadmap are 'safety of highly and fully automated vehicles', 'infrastructure safety', 'assessment of road user capabilities in future scenarios of road transport', 'predictive safety assessment and validation framework', 'safe inclusion of new means of transport into the traffic system' and 'safe human-technology interaction in the digital traffic system', all of these relate to CAV.

- Roadmap on Connected and Automated Transport (Road, Rail and Waterborne)by STRIA (Strategic Transport Research and Innovation Agenda)

The STRIA roadmap on connected and automated transport,[53] released April 2019, consists of the following: Policy objectives and challenges, State of the Art, Hurdles and Opportunities, Roadmaps and Plans, Programs and Projects, Research and Innovation Initiatives, Action Plan, and Conclusions and Recommendations. It covers road, maritime and aviation. For road the roadmap identifies initiatives and actions that are tangible and specific in terms of content, timing and responsibility. It is intended to give advice for the prioritization of R&I topics for research programmes at European and national levels.

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[50] SCOUT, "Visualization of European," 18 September 2018. [Online]. Available: https://connectedautomateddriving.eu/wp-content/uploads/2018/10/D54_Roadmap-final_NEW-1.pdf. [Accessed 23 September 2019].

[51] ERTRAC, "Connected Automated Driving Roadmap," 8 March 2019. [Online]. Available: https://www.ertrac.org/uploads/documentsearch/id57/ERTRAC-CAD-Roadmap-2019.pdf. [Accessed 23 September 2019].

[52] ERTRAC, "Safe Road Transport (Towards Vision Zero: Roads without Victims)," 8 March 2019. [Online]. Available: https://www.ertrac.org/uploads/documentsearch/id57/ERTRAC-CAD-Roadmap-2019.pdf. [Accessed 23 September 2019].

[53] STRIA, "Roadmap on Connected and Automated Transort (Road, Rail and Waterborne)," April 2019. [Online]. Available: https://ec.europa.eu/research/transport/pdf/stria/stria-roadmap_on_connected_and_automated_transport2019-TRIMIS_website.pdf. [Accessed 23 September 2019].

All three roadmaps set out the challenges associated with the development of CCAM solutions. These are summarised below in Table 37 according to their STEEP classification and a sub-categorisation as used in Table 1 of the main report.

Table 37: Categorisation of roadmap challenges

	Sub category of challenge	Roadmap challenge
Social	**Meeting societal needs**	**SCOUT:** Lack of incentives, Integration in models for a sustainable future, expected safety level, Integration in urban planning, Compatibility with user expectation (fun, status symbol,...), With interaction - VRUs and non-automated vehicles. **ERTRAC**: Human Factors **STRIA**: Consideration of societal needs and expectations towards CAD, particularly in terms of road and passenger safety as well as cyber security, and their translation into technical and legal requirements, alongside its potential for increased inclusiveness and its capacity to increase vehicle occupancy rate.
	Assessment of societal impacts	**SCOUT**: Insufficiently defined use cases **ERTRAC**: Socio economic assessment and sustainability
	Societal awareness and acceptance of CCAM	**SCOUT**: Acceptance of shared mobility services, user education, Building confidence and trust, awareness of user responsibility, ethic issues, data protection and privacy, acceptance of new mobility forms **ERTRAC**: User awareness, users and societal acceptance and ethics, driver training
Technical and technological	**Development of vehicle technology and safety critical systems**	**SCOUT**: User condition monitoring / sensing, Motion sickness, Communication handover EC transnational, Passive safety / integrated safety, Vehicle environment perception and event prediction, Vehicle decision making, Reliability of functional safety and validation, Failsafe operation and incident management, Applicability in all weather conditions, General activity monitory / awareness e.g. if passenger has a heart attack, OTA validation, Safety of Internalised functional assessment of the situation **ERTRAC**: In-vehicle technology enablers **STRIA**: Development, validation and testing of technologies for environment perception, vehicle decision making and control, infrastructure support and data communication that ensure a safe and comfortable ride at all levels of connected and automated road transportation of people and goods considering different operational environments.

	Sub category of challenge	Roadmap challenge
	Integration into the wider system	**SCOUT**: User-system interaction, missing behavioural schemes in incidents and accidents, digitalisation Traffic & Impact to mix traffic, challenge of ADV by people, interaction with Enforcement of Law – post crash, police stop, integration in traffic management and control, communication with infrastructure (digital / physical), requirements for maps and localisation, privacy and cyber security, adaptation to regulation needs, management of mixed traffic, interaction with other road users (VRUs animals), post-crash management (reduce effects of incident once happens), data communication V2Other V, RV, ……., handle of end of life of the vehicle **ERTRAC**: Big data, artificial intelligence and their applications, digital and physical infrastructure, including connectivity **STRIA**: Understanding human factors in the interactions between drivers, passengers and other road users with connected and automated vehicles, and finding appropriate technical solutions in the engineering process, Support the standardisation and harmonisation (profiling) of solutions to assure interoperability among different operational environments, road infrastructures and vehicles.
Economic	**Commercially viable deployment**	**SCOUT**: Take in consideration new use case definitions User as passenger or as business entity, Potential price for automated/connected driving -> willingness to buy, Public funding, Cost factor of vehicle and infrastructure, Maintenance requirements, Incomplete cost benefit analysis, Uncertain investment strategies, not proven permission of ACP is cheaper than conventional. **ERTRAC**: New Mobility Services, shared economy and business models, deployment **STRIA**: Identification of business and operational models to exploit the opportunities of CAD to provide future integrated mobility services, and to avoid the risk of increased numbers of vehicles, e.g. in terms of shared and automated mobility, and combination with public transport.
	Industry / Jobs / workforce	**SCOUT**: effects of job market, Skill degradation, Skills teleoperation and traffic management
Environmental	**Increases in road transport**	None listed
Political, policy and regulatory framework	**CCAM testing and approval**	**SCOUT**: Missing functional safety standards, Cross-border harmonisation, type approval procedures, Framework for vehicle testing, Infrastructure standard for minimum performance **ERTRAC**: Safety validation and roadworthiness testing **STRIA**: Adaptation of the legal frameworks of road transport to CAD, regulating in a harmonized way, testing methodologies and the conditions for the use of CAD on the road, and how liability issues are handled.

	Sub category of challenge	Roadmap challenge
	Protecting wider society	**SCOUT**: Lack of ethical rules for data ownership, Lack of ethical rules for AI, Lack of ethical rules for accident programming, Uncertainty of legal framework, Liability for user mis-behaviour, Missing law enforcement procedures, Liability for system failure, Data privacy protection, Protection against cyber-crime, terror etc, Data Privacy protection uniformity
	Wider policy	**SCOUT**: Missing policy framework. Need for political support, Policy framework will come when technology and vision is more mature, Uncertainty of policy framework, Vienna convention, User "licensing", Road code adaptation, Limit to low speed on private grounds, Regulation of usage, e.g. empty trips **ERTRAC**: Policy and regulatory needs, European harmonisation

D.3 Wider Policy

The G7 Transport Ministers' meeting declaration on the development and widespread utilisation of advanced technology for vehicles and roads,[54] highlights the importance of collaboration. In order to avoid duplication and improve road safety, efficiency and environmental performance, interests need to be shared and collaboration in research is required. The declaration states that 'it is important for government, industry and academia to work together to support the safe and effective deployment of automated and connected vehicle technologies'.

In its 'EU strategy for mobility of the future',[55] the Commission states that it will support the international technical harmonisation of automated vehicles within the framework of the United Nations in coherence with EU rules. In addition, the Commission proposes the use of the expected tasks of the driver and vehicles for the different levels of automation[56] established under the framework on the United Nations to ensure consistency between national traffic rules and avoid contradiction with EU vehicle rules.

The UN's framework document on automated/autonomous vehicles[57] specifies a safety vision, lists key issues and principles to be considered by WP29[58] (including system safety,

[54] G7 Transport Ministers, "Meeting Declaration on Development and Widespread Utilization of Advanced Technology for Vehicles and Roads," 24 September 2016. [Online]. Available: https://www.bmvi.de/SharedDocs/EN/Documents/K/g7-declaration-on-development-and-widspread-utilization-of-advanced-technology-for-vehicles-and-roads.pdf?__blob=publicationFile. [Accessed 23 September 2019].

[55] European Commission, *On the road to automated mobility: An EU strategy for mobility of the future,* Brussels: COM(2018) 283 final, 2018.

[56] UNECE, "Reference document with definitions of Automated Driving under WP.29 and the General Principles for developing a UN Regulation on automated vehicles," 23 April 2018. [Online]. Available: http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29resolutions/ECE-TRANS-WP29-1140e.pdf. [Accessed 23 September 2019].

[57] Representatives of China, European Union, Japan and the United States of America, "Framework document on automated/autonomous vehicles (levels 3 and higher)," 28 June 2019. [Online]. Available: https://www.unece.org/fileadmin/DAM/trans/doc/2019/wp29/WP.29-178-10r2e.pdf. [Accessed 23 September 2019].

[58] The UNECE World Forum for Harmonisation of Vehicle Regulations.

failsafe response, HMI, object event detection and response, operational design domain, etc.) and details priorities related to AVs.

D.4 Other studies

The key consumer trends identified in the 2019 Deloitte Global Automotive Consumer Study[59] show that while consumers are interested in the safety and time benefits of connected vehicles, there is little willingness to pay for them. There is also concern about sharing of private data. Confidence in the safety of self-driving vehicles has stalled, the majority want governments to exert a significant amount of control over the development and use of AVs. There is also little confidence that AV technology will be brought to market. The 'status quo' in terms of personal vehicle ownership is expected to remain and the number of people reporting regular usage of ride-hailing has decreased in the past two years. The idea of combining different modes of mobility into one trip remains largely an occasional behaviour for most consumers. Further information is provided in Table 38.

Table 38: Summary of 2019 Deloitte Global Automotive Consumer Study Findings

Area	Key Findings
Connected	Consumers may be reluctant to pay for connectivity. Consumers are most interested in time and safety benefits of connected vehicles.
Cooperative	The majority of consumers are somewhat/very concerned about the concept of biometric data (heart rate, blood pressure, blood alcohol level) being captured and shared with external parties.
Automated	Confidence in safety of self-driving vehicles has stalled in the last year following an improvement between 2017 and 2018. Majority want governments to exert a significant amount of control over the development and use of AVs. Confidence that AV tech will be brought to market continues to decrease.
Mobility	"Status quo" in terms of personal vehicle ownership and use is expected to remain. The idea of combining different modes of mobility into one trip remains largely an occasional behaviour for most consumers. The number of people reporting regular usage of ride-hailing has decreased in the past two years.

The "key trends" identified in KPMG's 2019 automotive executive survey are shown in Table 39. Points 1, 5, 6, 8, 9 and 10 (shown in bold) are particularly relevant to the area of CCAM. Connectivity and digitalisation come top of both European and global survey results, whilst autonomous and self-driving cars is further down the list in 6th place globally.

Table 39: Key trends until 2030 according to automotive executive survey (2019)[60]

	EU	Global
1. Connectivity and digitalisation	**58%**	**59%**
2. Battery electric mobility	58%	56%
3. Fuel cell electric mobility	53%	56%

[59] Deloitte, "2019 Deloitte Global Automtive Consumer Survey," [Online]. Available: https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Consumer-Business/gx-global-automotive-consumer-study-2019.pdf.

[60] KPMG, "Global Automotive Executive Survey 2019," 2019. [Online]. Available: https://automotive-institute.kpmg.de/GAES2019/downloads/GAES2019PressConferenceENG_FINAL.PDF. [Accessed 23 01 2020].

	EU	Global
4. Hybrid electric mobility	52%	52%
5. Understanding the mobility ecosystem	**43%**	**47%**
6. Autonomous and self-driving cars	**43%**	**44%**
7. Market growth in emerging markets	42%	50%
8. Mobility as a service	**42%**	**43%**
9. Creating value out of big data	**41%**	**45%**
10. Platform strategies and standardisation of modules	**35%**	**40%**
11. Downsizing of internal combustion engine (ICE)	32%	35%
12. Rationalisation of production in Western Europe	30%	31%

As well as trends within the automotive sector, there are also societal trends that are expected to impact the field. The ITF summarised long-term projections for transport demand in 2050 in the OECD ITF Transport Outlook 2019 summary[61] and highlighted an expected increase in the following: Overall transport demand, demand for shared mobility, demand for freight (partly due to increase in e-commerce), emissions from transport, use of autonomous vehicles, increase in teleworking. These are summarised in Table 40 below.

Table 40 Key trends identified in ITF Transport Outlook (2019)

Increasing overall transport demand	It can be stated with some confidence that, globally, demand for mobility will continue to grow over the next three decades. Passenger transport will increase nearly three-fold between 2015 and 2050, from 44 trillion to 122 trillion passenger-kilometres.
Increasing demand for shared mobility	Although private vehicles are expected to remain the most popular mode of travel, travel in cities especially will shift towards public transport and shared mobility. By 2050, both these modes are projected to account for over 50% of total passenger-kilometres. Shared mobility could halve the number of vehicle-kilometres travelled in urban areas if widely adopted. This could lead to a 30% decrease in CO2 emissions from urban transport by 2050 relative to projections based on current ambitions.
Increasing global freight demand	Global freight demand will triple between 2015 and 2050 based on the current demand pathway.
Increase in e-commerce	Rapid growth in e-commerce could lead to modest increases in freight volumes of between 2% and 11%, depending on the transport mode. Freight-related CO2 emissions would increase by 4%. The large-scale uptake of 3D printing in manufacturing and for home use could reduce global freight volumes by 28% and related CO2 emissions by 27% compared to a current ambition scenario. This level of uptake in 3D printing is not particularly likely, however.

[61] ITF, "ITF Transport Outlook 2019," 2019. [Online]. Available: https://safety4sea.com/wp-content/uploads/2019/05/ITF-ITF-Transport-Outlook-2019-Summary-2019_05.pdf. [Accessed 23 01 2020].

Increasing emissions from transport	The extrapolation of current policy ambitions into the future shows that these will fail to mitigate increases in transport CO2 emissions in the face of strong growth in transport demand over the coming years. In a scenario where current and announced mitigation policies are implemented, worldwide transport CO2 emissions are projected to grow by 60% by 2050. This growth is driven mainly by increased demand for freight and non-urban passenger transport, both of which are projected to grow 225% by 2050. Emissions from urban passenger transport, in contrast, are projected to fall by 19%, reflecting existing strong focus of current policies on urban transport. More ambitious decarbonisation policies significantly alter the projected pathways for transport demand and related CO2 emissions. Global demand for passenger transport would be 20% lower in 2050, and related emissions 70% lower, relative to a current ambition scenario. Global demand for freight transport would remain relatively stable in both scenarios but carbon emissions from freight transport would be 50% lower in 2050 relative to a current ambition scenario. Yet even this would fail to deliver the reductions required to achieve the Paris Agreement objective of maintaining the average global temperature increase to well-below 2 degrees Celsius above the pre-industrial era. Simulations indicate that the use of high capacity vehicles and autonomous trucks in road freight transport would not have significant impacts on overall demand for freight transport or freight-related emissions.
Increased use of autonomous vehicles	The widespread use of autonomous vehicles would likely increase the number of vehicle-kilometres travelled and tonnes of CO2 emissions generated in most urban regions.
Teleworking	Simulations indicate that more teleworking could decrease global urban passenger-kilometres travelled and related CO2 emissions by around 2% in 2050 compared to the current ambition scenario.

D.5 Publications

Publications can be expected predominantly from the academic partners – to some extent also from research organisations, but much less so from industry partners. If industry is involved in scientific publications, then almost exclusively with an academic partner.

Table 41 shows the number and share of publications by year under the main H2020 programme. The Smart, green and integrated transport programme produced the most publications – 54 in total.

Table 41: Number and share of publications by year

Main Programme under H2020	2015	2016	2017	2018	2019	Total	Share
Information and Communication Technologies	5	4	15	11	4	39	**40%**
Marie-Sklodowska-Curie Actions				3		3	**3%**
Smart, green and integrated transport	2	15	13	20	4	54	**56%**
Space				1		1	**1%**
Total	7	19	28	35	8	97	**100 %**
Share	**7 %**	**20 %**	**29 %**	**36 %**	**8 %**	**100 %**	

Source: DG RTD, calculation: Technopolis Group

Table 42 shows how the publications were distributed across the different call topics. The call "Cooperative ITS for safe, congestion-free and sustainable mobility" produced the most publications, with 37 in total.

Table 42: Evolution of CCAM publications by topic of calls

Topics of calls	2015	2016	2017	2018	2019	Total	Share
Big data and Open Data Innovation and take-up				1		1	**1%**
Connectivity and information sharing for intelligent mobility		1				1	**1%**
Cooperative ITS for safe, congestion-free and sustainable mobility	2	13	8	13	1	37	**38%**
ECSEL Key Applications and Essential technologies (RIA)			1	6	4	11	**11%**
EGNSS Transport applications				1		1	**1%**
Large-scale demonstration(s) of cooperative ITS				1	1	2	**2%**
Research and Innovation Staff Exchange				3		3	**3%**
Robotics		1				1	**1%**
Safe and connected automation in road transport			4	4		8	**8%**
Safety and end-user acceptance aspects of road automation in the transition period			1	1		2	**2%**
Smart Cyber-Physical Systems	5	3	14	4		26	**27%**
Traffic safety analysis and integrated approach towards the safety of Vulnerable Road Users		1			2	3	**3%**
Transport infrastructure innovation to increase the transport system safety at modal and intermodal level (including nodes and interchanges)				1		1	**1%**
Total	**7**	**19**	**28**	**35**	**8**	**97**	**100%**

Source: DG RTD, calculation: Technopolis Group
Note: the Ecsel call is also included in the candidate Ecsel partnership analysis.

17 H2020 projects in the field, listed in Table 43 below, produced 87 publications. The largest numbers can be found from UnCoVerCPS (26) and HIGHTS (19). The others produced more in the range of one or two.

Table 43: Number of publications by H2020 project

Project acronym	Number of publications by project	Project acronym	Number of publications by project
AutoDrive	11	PRoPART	1
AutoMat	1	PROSPECT	3

Project acronym	Number of publications by project	Project acronym	Number of publications by project
AutoMate	2	ROADART	9
C-MobILE	2	SAFE STRIP	1
COSAFE	3	TIMON	9
HIGHTS	19	UnCoVerCPS	26
interACT	2	UP-Drive	1
MAVEN	2	VI-DAS	4
OPTIMUM	1		

Source: DG RTD, calculation: Technopolis Group

The projects provide the information if a publication is a joint public-private co-publication, or not. While three quarters are non-collaborative, only one quarter is collaborative as shown in Table 44.

Table 44: Number and share of collaborative H2020 publications, by year

Joint Public/Private publications	2015	2016	2017	2018	2019	Total	Share
No	6	15	22	26	3	72	**74%**
Yes	1	4	6	9	5	25	**26%**
Total	7	19	28	35	8	97	**100%**

Source: DG RTD, calculation: Technopolis Group

The 87 publications were published in 49 different journals. Table 45 lists those journals with at least two publications.

Table 45: Main journals from H2020 CCAM publications

Journal Title	Total
IFAC-PapersOnLine	8
IEEE Transactions on Intelligent Transportation Systems	6
IEEE Transactions on Vehicular Technology	6
Automatica	4
IEEE Internet of Things Journal	3
IEEE Transactions on Wireless Communications	3
IET Intelligent Transport Systems	3
Journal of Power Sources	3
IEEE Access	2
IEEE Transactions on Automatic Control	2
IEEE Transactions on Communications	2
IEEE Transactions on Control of Network Systems	2
IEEE Transactions on Control Systems Technology	2
IEEE Transactions on Signal Processing	2
IEEE Wireless Communications Letters	2

Journal Title	Total
Journal of Advanced Transportation	2
Journal of Electrical and Computer Engineering	2
Transportation Research Procedia	2

Source: DG RTD, calculation: Technopolis Group

In order to analyse how CCAM R&I publications is performing in comparison of the rest of the world, we first need to define it in terms of scope. This can be done, for example, through journals or keywords. The Technopolis Group drew keywords from the publication titles, these point in the direction of transport but could equally be found in other fields. Obviously, it is not straightforward to delineate the field and distinguish it from other transport lines. By taking the title keywords 'automated' in combination with 'transport', the Technopolis Group were able to carry out a bibliometric analysis and find who is at the scientific forefront in the area of Safe and Automated Road Transport (based on analysis over period from 2010 to 2018).

Table 46 shows the most frequently used keywords in the field of CCAM between 2010 and 2018. "Automation" is the highest with 577 instances, and "Transportation" second with 246. Other notable keywords are Vehicles (196), Optimization (127) and Traffic Control (123). In particular "Traffic Control" re-enforces the CCAM scope that the R&I agenda is wider than autonomous vehicles alone.

Table 46: 30 Most frequently used keywords in the field of CCAM (2010-2018)

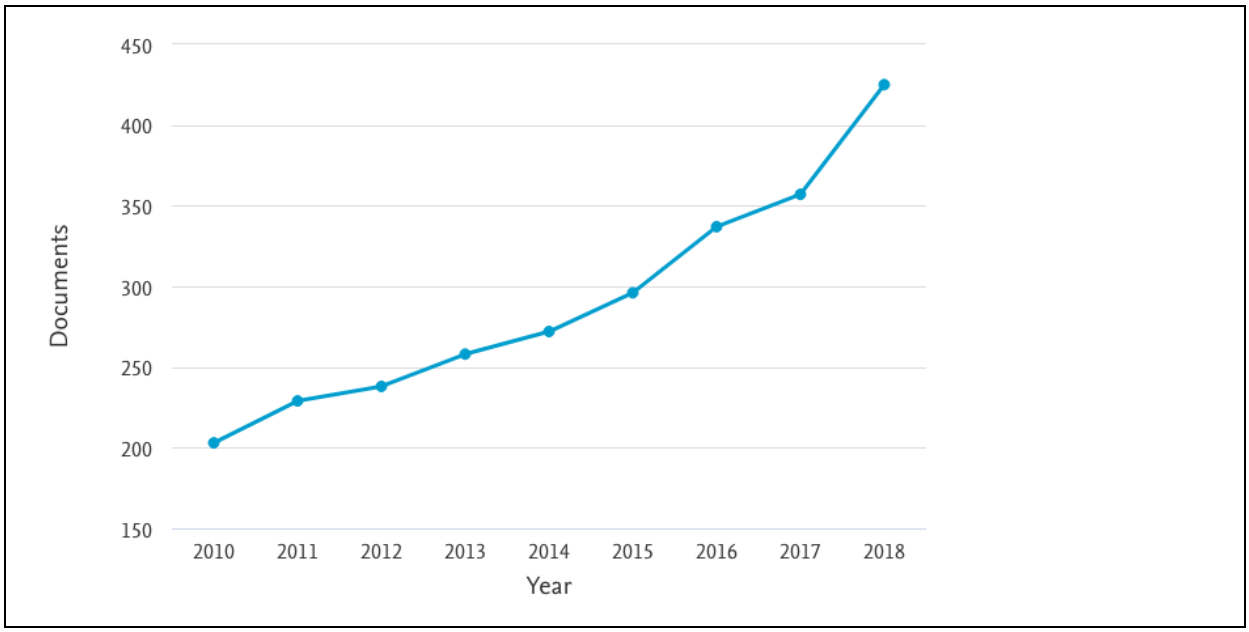
Keyword	Frequency	Keyword	Frequency
Automation	577	Automated Vehicles	73
Transportation	246	Robotics	72
Vehicles	196	Transport Systems	69
Optimization	127	Materials Handling	66
Traffic Control	123	Automatic Guided Vehicles	65
Intelligent Systems	111	Motor Transportation	63
Automated Guided Vehicles	102	Intelligent Vehicle Highway Systems	63
Algorithms	99	Design	62
Human	98	Manufacture	61
Humans	96	Intelligent Transport Systems	61
Public Transport	87	Sediment Transport	60
Roads And Streets	87	Animals	59
Algorithm	85	Mass Transportation	59
Computer Simulation	77	United States	59
Urban Transportation	75	Scheduling	57

Source: Scopus, calculation: Technopolis Group

Figure 56shows how the number of publications in CCAM has grown since 2010. Between 2010 and 2018, 2.600 publications were published. This is rather small field in particular compared to other candidate partnerships (see Figure 57). But a rather high annual

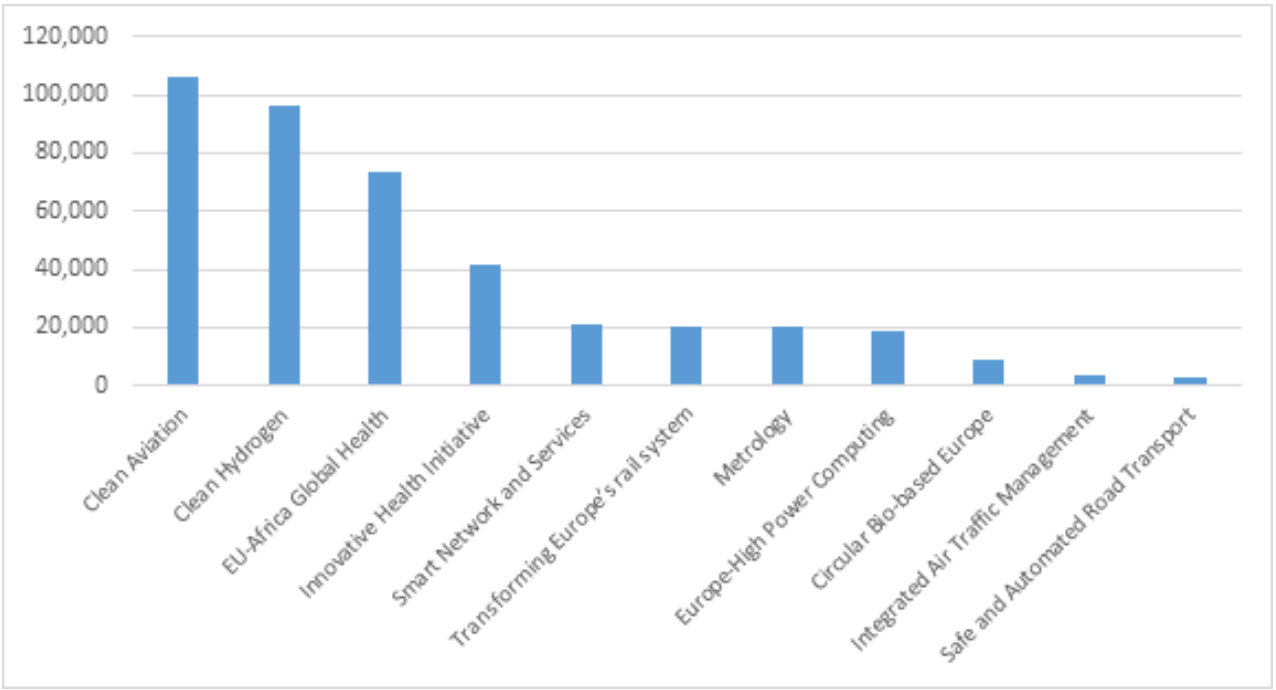
average growth of 9.7% can be calculated. With 53.3% articles and reviews dominating the type of publication, followed by conference papers (40.0%).

Figure 56: Evolution of the number of publications in 'automated transport' (2010 to 2018)



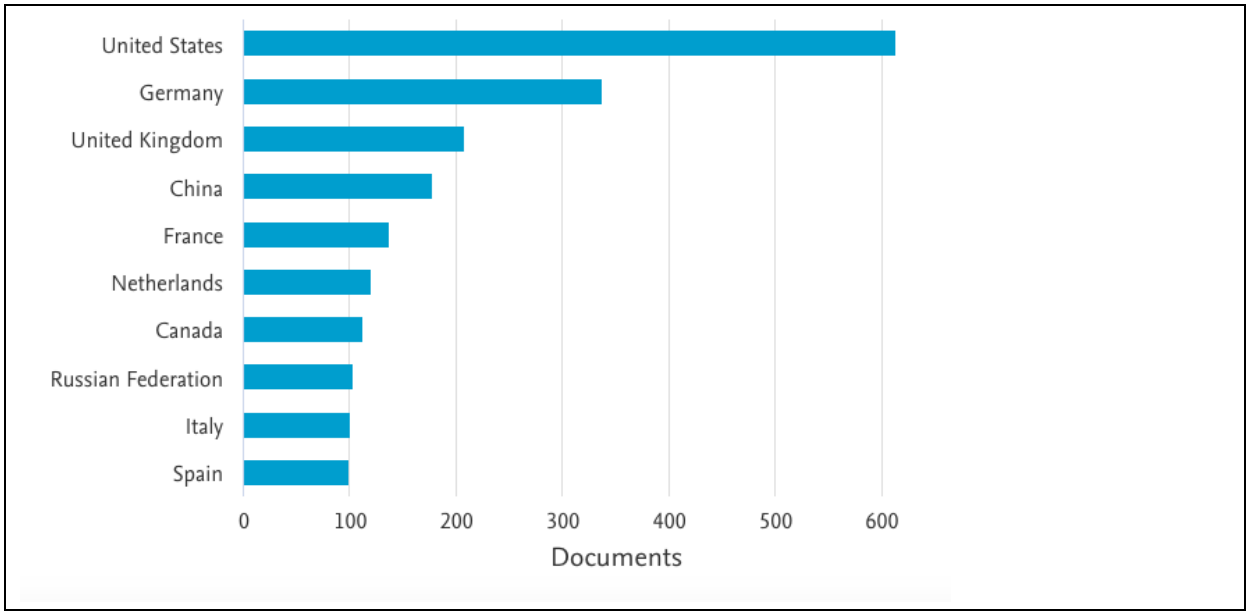
Source: Scopus, calculation: Technopolis Group

Figure 57: Publications between 2010 and 2018 per initiative (for which the information is available)



In terms of most prolific countries, Figure 58 suggests a very broad, worldwide, interest in the field and scientific competences in Europe, the Americas, and Asia.

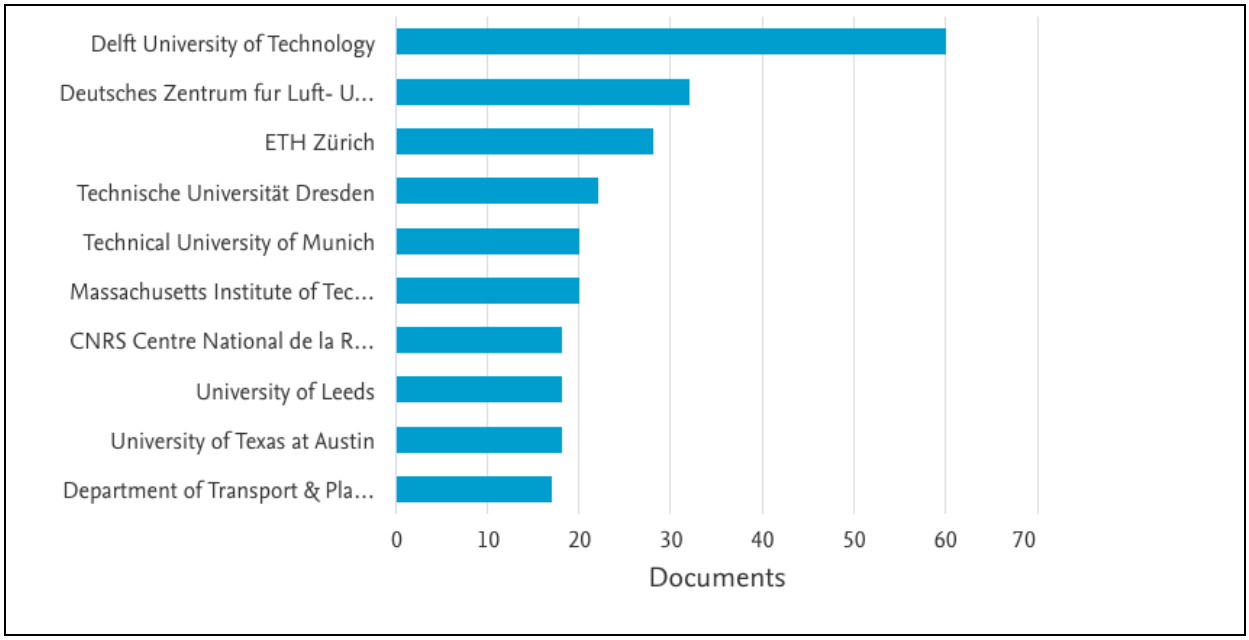
Figure 58: Main publishing countries in smart transport (2010 to 2018)



Source: Scopus, calculation: Technopolis Group

In terms of leading (most prolific) organisations, Figure 59 shows several EU technical universities (Delft, Dresden, Munich), but also the DLR and CNRS among the leading publishers. Except the MIT and the University of Texas, Austin, the top organisations are all from Europe.

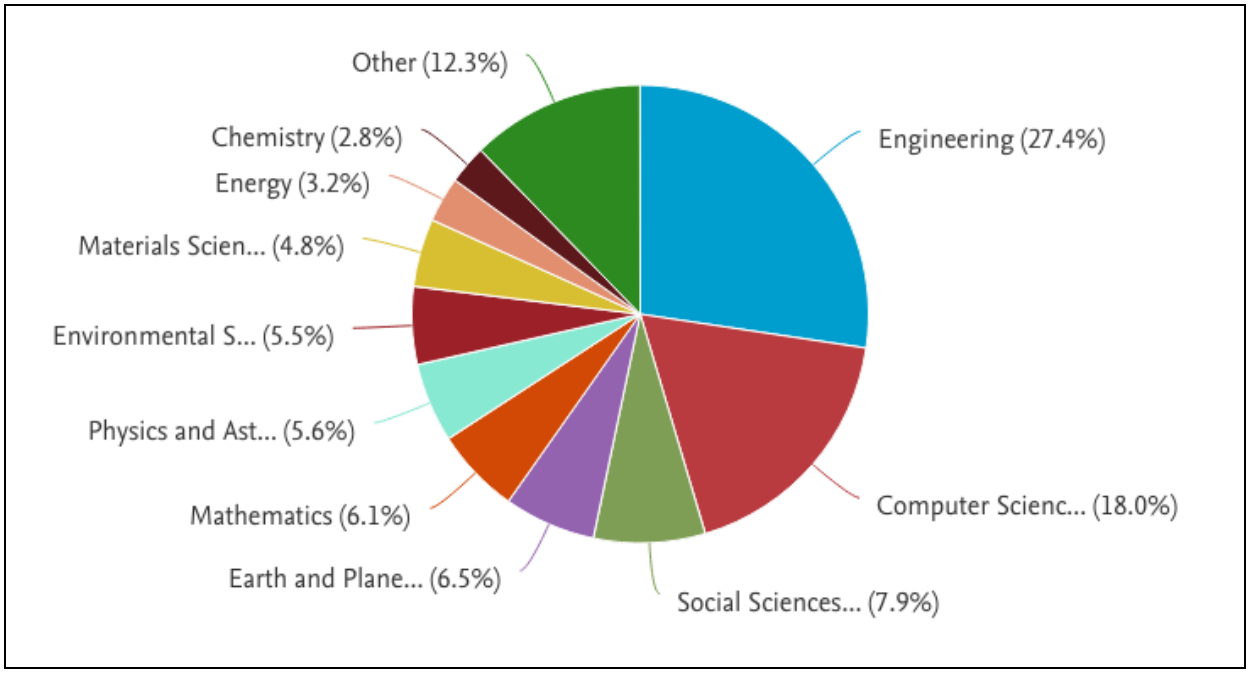
Figure 59: Most prolific organisations in the field of smart transport (publications 2010-2018)



Source: Scopus, calculation: Technopolis Group

In terms of scientific disciplines which are forming the basis of this field, Figure 60 indicates that in particular engineering is a key discipline, followed by computer sciences. The social sciences have a rather strong role (compared to many other technical areas) with 8%. In particular the computer sciences is an important knowledge base. Its publication use in this area has growth by 11.4% on average annually.

Figure 60: Scientific disciplines forming the field



Source: Scopus, calculation: Technopolis Group

D.6 Patents

Unlike publications, patents can be expected from industry partners since they have a genuine interest in protecting their innovation. However, due to competition, business practices and the pre-competitive nature of collaborative R&D projects at EU-level, etc. most industrial partners are likely to apply for IPR outside of the H2020 context. This is illustrated by the fact that only three H2020 projects applied for IP. Three patents were filed at EPO from the ESPRIT project (by a government agency); in MAVEN a patent was applied for by a company and in JAM, five trademarks were registered.

The Automobile Industry Pocket Guide[62] published by the European Automobile Manufacturer's Association in 2019 summarises patents outside of the context of H2020. The EU made up 53% of patents in the automotive sector in 2018, with Japan second on 28%, the US on 12% and China on 1.8%.

More specifically in relation to self-driving vehicles (SDV) the European Patents Office released a report in November 2018[63] summarising SDV patent applications in Europe. The EPO identified patents from all technologies enabling the full automation of vehicles. The corresponding SDV patent applications were divided into two main technology sectors, each of which is in turn subdivided into a number of SDV technology fields as shown in Table 47.

[62] ACEA, "The Automotive Industry Pocket Guide," June 2019. [Online]. Available: https://www.acea.be/uploads/publications/ACEA_Pocket_Guide_2019-2020.pdf.

[63] EPO, "Patents and Self Driving Vehicles," November 2018. [Online]. Available: https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/2019-autonomous-vehicles-readiness-index.pdf. [Accessed 23 01 2020].

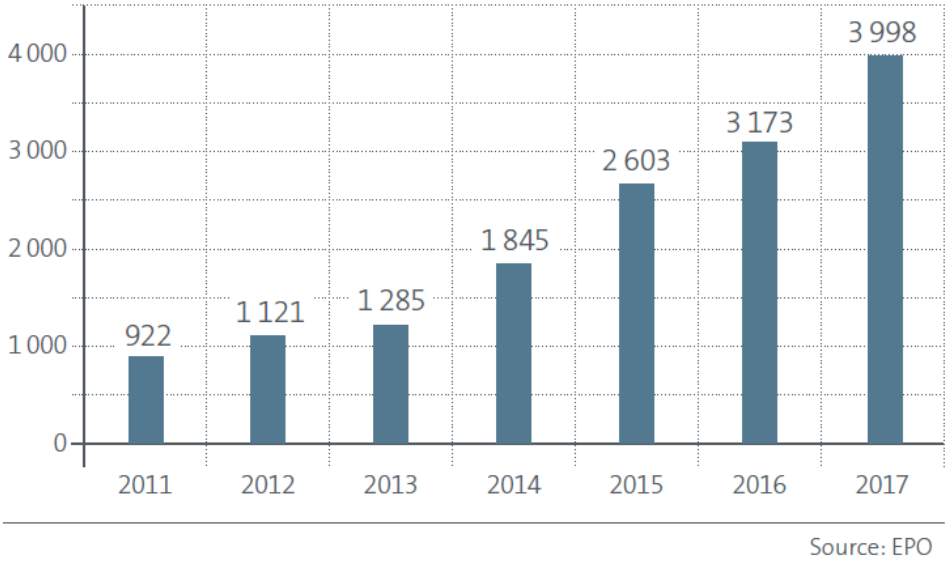
Table 47: Categorisation of patents at the EPO

Technology sector	SDV technology field	Technology examples
Automated Vehicle Platform encompasses technologies that are embodied in the vehicle itself	**Perception, analysis & decision** inventions that enable vehicles to make autonomous decisions	Short-, medium-, long-range radar for adaptive cruise control Cameras for lane departure warning/control, traffic sign recognition, surround view Navigation and mapping systems Adaptive cruise control (ACC) and platooning Scene perception and modelling Vehicle stability, dynamic chassis control, conjoint control of stability systems
	Vehicle handling inventions in the automated parts of the vehicle	Bus systems Supervisory systems for fault recognition and recovery Artificial intelligence Computer security Diagnostics and fault management
	Computing inventions in the underlying hardware and software technologies	Automatic steering Vehicle suspension control Control systems for road vehicle drive control Powertrains: battery electric vehicles (BEV); hybrid vehicles; efficient internal combustion engine vehicles
Smart Environment comprises technologies that enable SDVs to interact with each other and with their surroundings	**Communication** inventions in vehicle connectivity and related communication infrastructure	5G network MM wave antenna arrays technology Cloud for learning and updating high-definition maps and traffic data Cellular communication systems for vehicle applications Traffic signal arrangements Road embedded sensors and signalling Connection management for emergency connections (eCall)
	Smart Logistics inventions in traffic management, vehicle identification, automated	Fleet management

Technology sector	SDV technology field	Technology examples
	parking and interfaces between vehicles and the electricity grid	Traffic control systems for road vehicles Automated parking Inductive on-road recharging systems Smart grids in transport

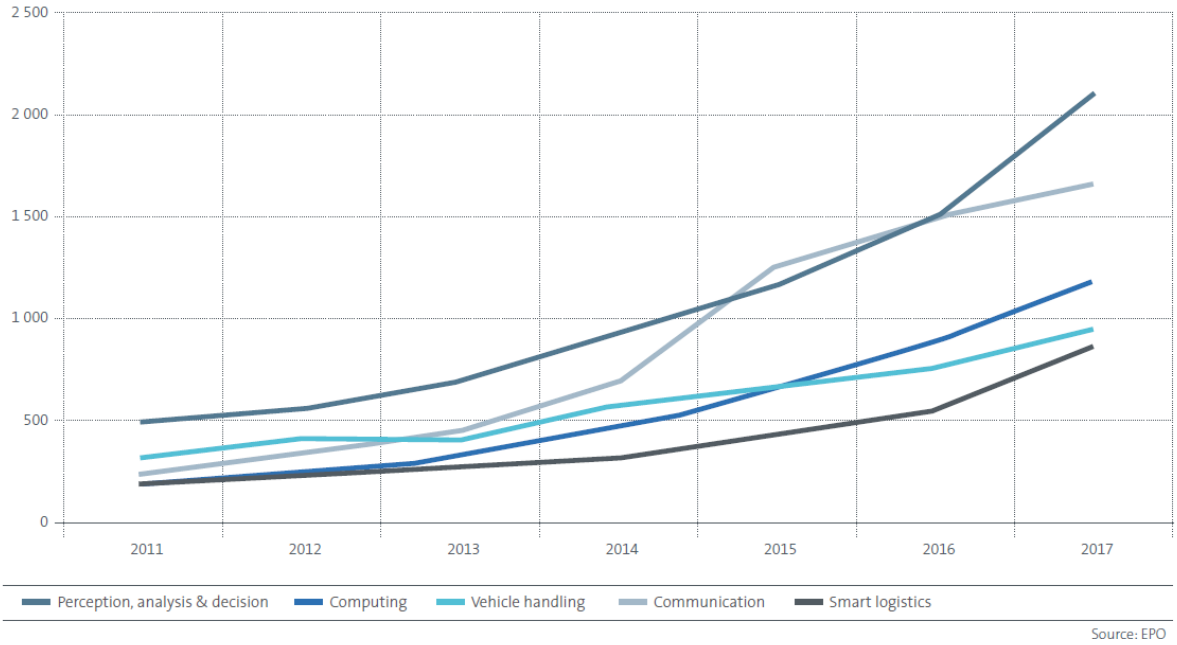
Figure 61 shows the SDV patent applications at the EPO from 2011 to 2017. There is a steep rise in patent applications on self-driving vehicles with almost 18,000 patent applications relating to SDV technologies filed in the last ten years, almost 4 000 of them in 2017 alone. Annual applications relating to SDVs increased by 330% compared with 2011, growth rate that is more than 20 times faster than that for patent applications in general at the EPO in the same period.

Figure 61: SDV patent applications at the EPO 2011 to 2017



The patent applications by SDV technology field are shown inFigure 62. Perception, analysis & decision is the largest SDV technology field, while Communication and Computing technologies have grown the fastest since 2011.

Figure 62: SDV patent applications at the EPO by technology field 2011-2017



Source: EPO

The different types of applicant across the different technology fields are shown in Table 48. The main applicant group was the automotive sector, with the "ICT for automotive" sector showing a high proportion, especially in the field of computing and communication.

Table 48: Main applicant groups for SDV patent applications at the EPO and their technology profiles 2011-2017

	Automotive	Other transport	Machinery & electrical equipment	Telecom	ICT for automotive	Other
Perception, analysis & decision	44.4%	9.9%	13.6%	4.2%	23.8%	4.2%
Computing	33.6%	7.6%	14.4%	9.1%	30.4%	4.9%
Vehicle handling	63.4%	4.6%	15.8%	2.2%	10.8%	3.3%
Communication	18.5%	3.6%	6.9%	25.1%	42.6%	3.3%
Smart logistics	48.7%	7.0%	19.6%	5.1%	15.4%	4.1%

Source: EPO

The top 25 patent filing organisations are shown in Figure 63. The two top filing organisations, Samsung and Intel, are both classified as ICT for automotive organisations. Out of the 25 companies only 5 are "Tier 1" OEMs (i.e. Toyota, Volvo, Audi, Honda and Nissan).

Figure 63: Top 25 SDV applicants at the EPO 2011-2017

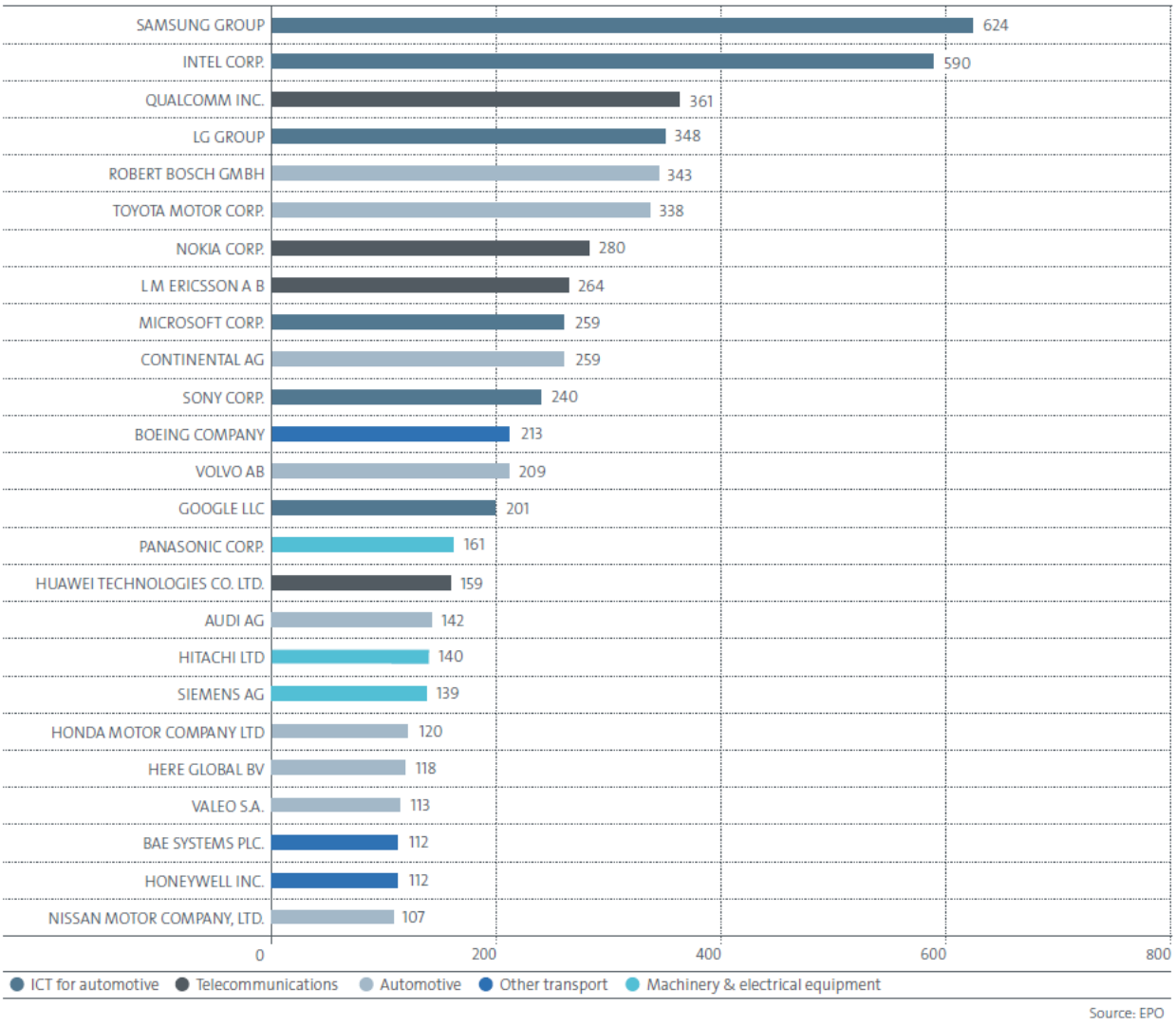


Figure 64 shows the breakdown of patents between 2011 and 2017. Filed patents between 2011 and 2017 from companies based in European countries had the highest proportion at 37.2%, with the United States second with 33.7%. Japan had 13.3%, Korea 7.3% and China 3.2%. Germany had the highest number of patents in the EU, with France second with 4.8%.

Figure 64: Geographic origins of SDV applications 2011-2017

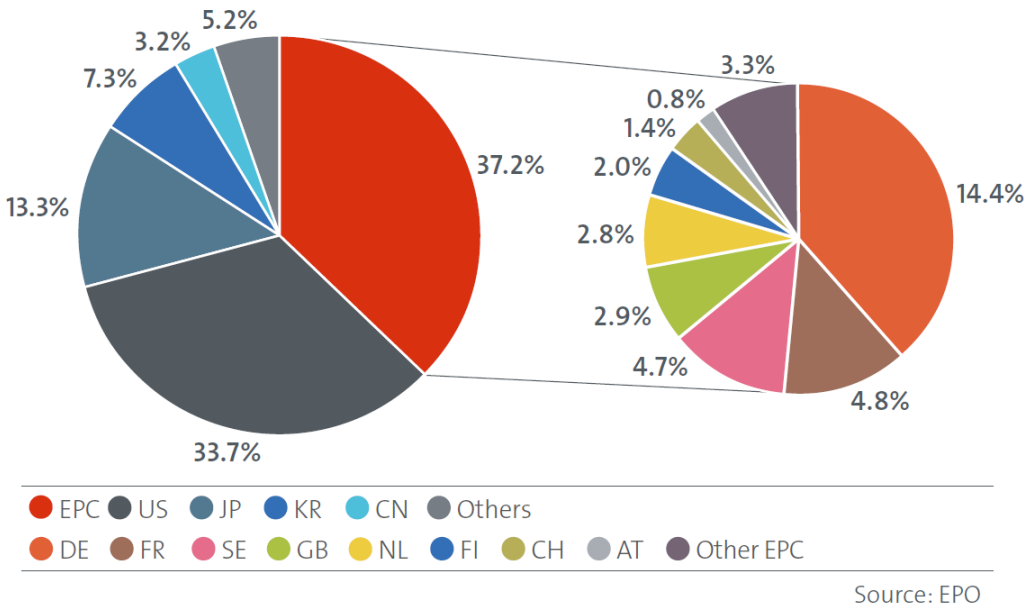
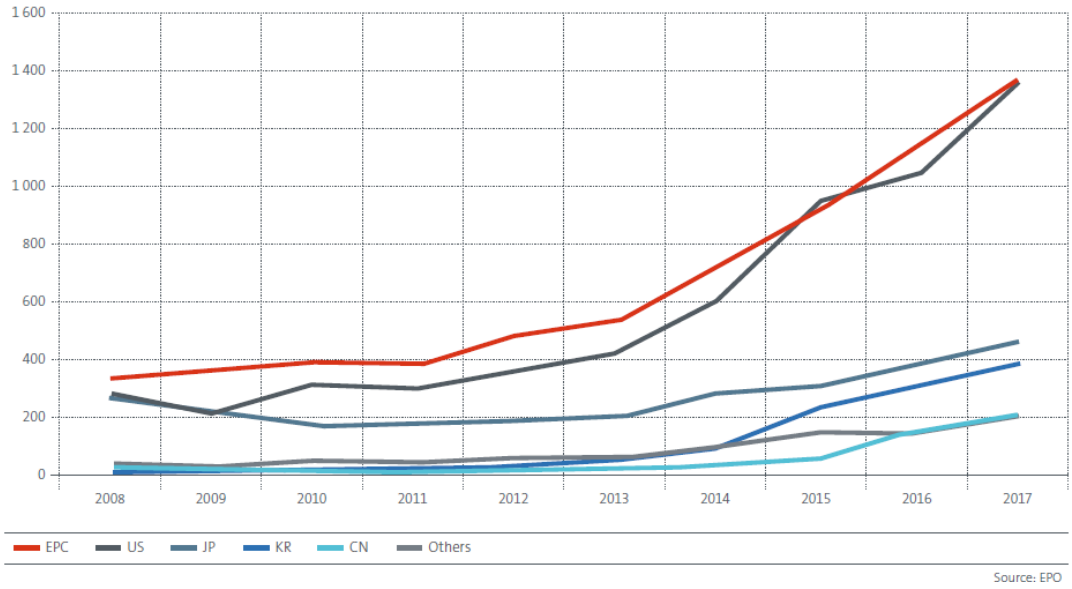


Figure 65 shows the patent applications at the EPO over time by region. The United States shows a sharp increase in patents from 2016 to 2017 joining level with the EU in 2017. Although China has a low number of patents overall it showed a sharp rise (almost quadruple) between 2015 and 2017 from 57 to 193.

Figure 65: Origin of patent applications at the EPO in SDV technologies 2008-2017



D.7 CCAM platform

In June 2019 the European Commission established a Single Platform for Cooperative, Connected and Automated Mobility (CCAM) with the aim to receive advice and support in the field of testing and pre-deployment activities for CCAM.

The CCAM Single Platform is a joint initiative of Directorate-General for Mobility and Transport (DG MOVE), Directorate-General for Communications Networks, Content and Technology (DG CNECT), Directorate-General for Internal Market, Industry, Entrepreneurship and SME's (DG GROW) and Directorate-General for Research and Innovation (DG RTD).

The objective of the CCAM platform is to better coordinate CCAM development and pre-deployment and to create synergies in testing and implementation of CCAM in and between EU Member States, and with the industry.

The aim of the platform is to advise and support the EC in the area of open road testing and making the link to pre-deployment activities. This is done through the coordination of CCAM research, piloting, testing and deployment activities, in order to increase their efficiency and effectiveness as well as integrate existing fora. The platform also addressees any issues related to data access and exchange, digital and road transport infrastructure, communication technology, cybersecurity and road safety.

The CCAM Platform consists of an informal group (including a signed MOU) of both private and public stakeholders. The group includes 137 organisations in the field of CCAM and are appointed for three years. The makeup of the group according to type of organisation is provided in Figure 6 , with a more detailed list provided in Table 49.

The inaugural CCAM Platform meeting was held on 26th September 2019 and led to the establishment of six platform working groups:

- WG 1: Develop an EU Agenda for research, testing and pre-deployment of Connected, Cooperative and Automated Mobility (CCAM)
- WG 2: Coordination and cooperation of R&I and testing activities
- WG 3: Physical and Digital Road Infrastructure
- WG 4: Road Safety
- WG 5: Cybersecurity and access to in-vehicle data linked to CCAM
- WG 6: Connectivity and digital infrastructure for CCAM

The CCAM Platform Working Group 1 is developing a document to identify the platform's views on the objectives and priorities for a future EU agenda for research, testing and pre-deployment of Connected, Cooperative and Automated Mobility. The main research areas of the CCAM platform R&I agenda is provided in Table 50.

Table 49: CCAM platform membership by organisation category

#	Category	Total number of organisations in each category
1	01. EC	6
2	02. Member States	25
3	03. Industry - association of car manufacturers/ ITS providers	2
4	03. Industry - car manufacturing	9
5	03. Industry - car manufacturing (trucks)	2
6	03. Industry - association of automotive manufacturing companies/groups	1
7	03. Industry - association of car manufacturers' research institutes	1
8	03. Industry - bus and/or truck manufacturers	2
9	04. Industry - association of motorcycle manufacturing companies/groups	1
10	04. Industry - motorcycle manufacturing	1

#	Category	Total number of organisations in each category
11	05. Industry - bicycle manufacturing	1
12	06. Industry - car parts manufacturing	5
13	07. Industry - association of tyre manufacturers	1
14	07. Industry - tyre manufacturing	1
15	08. Industry - car repair services	1
16	09. Association - ITS providers	1
17	09. Industry - association of ITS providers	1
18	09. Industry - ITS consultancy	2
19	09. Industry - ITS solution provider (automation)	1
20	09. Industry - ITS solutions provider	10
21	09. Industry - technology provider	1
22	09. Others - ITS consultancy	1
23	10. Industry - association of automotive and electronic communications companies/groups	1
24	10. Industry - association of digital companies/groups	1
25	10. Industry - electronic communications	5
26	11. Industry - transport services company/group	1
27	11. Industry - association of road transport operators	1
28	12. Industry - association of insurance companies/groups	1
29	12. Industry - insurance	3
30	13. Association of research institutes	3
31	13. Research institute	9
32	14. Association - associations, MS and research institutes	1
33	14. Association - R&I cluster	1
34	15. Association - road infrastructure managers/operators, ITS solution providers	1
35	15. Public/para-public - association of road infrastructure managers/operators	4
36	15. Public/para-public - road infrastructure manager/operator	10
37	16. Public/para-public - association of cities and/or regions	2
38	17. Public/para-public - public transport authorities and operators	1
39	17. Public/para-public - public transport authorities and operators (individual expert)	1
40	18. Public/para-public - association of technical Inspection entities	2

#	Category	Total number of organisations in each category
41	19. Public/para-public - logistics	1
42	20. Mobility solutions	1
43	20. Public/para-public - smart mobility advisory	1
44	21. Association - road safety	2
45	22. Other - association of motoring and motor sport clubs	1
46	23. Other - association of motorcyclists	1
47	24. Other - provider of testing facilities	2
48	24. Other - provider of testing services and analysis	2
49	25. Other - association of driving schools	1

Table 50: CCAM Single Platform R&I Agenda

	R&I action areas
Technological development	**1. Environment perception** - Reliable environment perception to identify and predict all hazards of automated driving systems
	2. Cyber-secure Electronics - Fail-operational and cyber secure electronic and software control architectures for CCAM
	3. Passive and active safety for CCAM - Integrated safety systems for accident avoidance and protection for CCAM
	4. On-board decision making – reliable localisation and dynamic map technologies, digital traffic rules
	5. Vehicle validation – physical and virtual assessment tools
	6. Human-Machine interaction and interface design - for on-board users and surrounding road users.
	7. Remote operation and surveillance to ensure safety of CCAM in particularly complex and challenging situations
	8. Physical and digital infrastructure (PDI) - PDI ecosystem for CCAM, covering infrastructure needs, in all areas, for different automation levels, matching the vehicle ODD
	9. Connectivity / cooperative systems - secure solutions to facilitate and improve CCAM, interaction between CAVs, infrastructure, traffic management services and other road users
	10. Artificial Intelligence - Concepts, techniques and models for CCAM applications and services

	R&I action areas
Service design, demonstration and impacts	**11. Smart, shared, automated mobility solutions -** understand user acceptance and requirements of smart, shared, automated mobility solutions and foster the development of technologies and business models, in particular to encourage shared mobility
	12. Fleet and (mixed) Traffic Management – integration of CCAM systems and services in fleet and traffic management
	13. Development and demonstration of shared automated mobility solutions and their integration in the transport system
	14. Large-scale demonstration of highly automated passenger vehicles and their integration in the transport system
	15. Large-scale demonstration pilots of automated commercial/heavy duty vehicles and their integration in the transport system
	16. Societal needs analysis - understand customer, market and societal expectations and opportunities
	17. Socio-economic impact assessment, including environmental impact assessment to better understand the potential for emission reduction, change in mobility demand, skills and jobs, etc.
	18. Workforce development - Labour market effects of CCAM and push and pull measures to facilitate the transition of work force
R&I coordination and integration	**19. Strategic European agenda for R&I and large-scale testing**, including links with other R&I areas/partnerships
	20. European framework for testing on public roads – all areas, all vehicles, ensure safe testing
	21. Data exchange framework in the context of cross-border testing and learning
	22. EU-wide knowledge base, including common scenario database
	23. Common evaluation framework and KPI's - to allow comparability of results, complementing evaluations and meta-analysis over multiple evaluation studies
	24. Data storage and sharing - Data storage and sharing for improving/advancing CCAM

D.8 H2020 funding calls and publications

As summarised in 'On the road to automated mobility: An EU strategy for mobility of the future',[64] between 2014 and 2020, a significant budget was allocated to support research and innovation on automated vehicles, with the focus areas including large scale

[64] European Commission, *On the road to automated mobility: An EU strategy for mobility of the future,* Brussels: COM(2018) 283 final, 2018.

demonstration pilots, user acceptance, design of a safe HMI, road infrastructure to support automation, and testing and validation procedures.

These H2020 projects have been analysed using the TRIMIS database,[65] where H2020 projects categorised as "Connected and Automated Transport – Road Transport" and commenced from January 2015 have been filtered. These are referred to as the "CCAM H2020 projects" in the remainder of this report.

A breakdown of funding by stakeholder type is provided in Table 51 below. Private Research Companies (PRC) took the majority of the greatest share of costs at 61.2%. Public Research Centres and Higher Education Centres took a similar amount (20% and 15% respectively), and the public sector and "others" took a much smaller proportion (2%). In total there were 630 different organisations receiving funding.

Table 51: CCAM H2020 projects (2014 to 2020) total costs of R&I activities

Type of Organisation (as distinguished by CORDA)		Sum of Participant Total Cost	Percentage of Total Cost
PRC	Private Research (companies)	€ 332,229,490	61.2%
REC	Research Centres (public)	€ 107,725,506	19.8%
HES	Higher Education (universities)	€ 78,627,084	14.5%
PUB	Public, Non-Profit Organisations	€ 12,473,740	2.3%
OTH	Other	€ 12,031,293	2.2%
	Total Spend:	**€ 543,087,113**	

Under each of the organisation types, the top five companies by total cost are shown in Table 52. The company with the highest costs was Infineon Technologies with about €12.5M of project costs, 4% of the total PRC allocation.

Table 52: Key stakeholders for each industry type, according to the participant's total cost as a percentage of spend on the organisation type under Horizon 2020 (top 5 listed here).

Company	NACE category	Org type	Total project costs	% of funding from org type
INFINEON TECHNOLOGIES AG	Manufacture of computer, electronic and optical products	PRC	€ 12,495,877	4%
DAIMLER AG	Manufacture of motor vehicles, trailers and semi-trailers	PRC	€ 10,319,204	3%
ROBERT BOSCH GMBH	Manufacture of machinery and equipment n.e.c.	PRC	€ 9,676,616	3%
EUROPEAN ROAD TRANSPORT TELEMATICS IMPLEMENTATION COORDINATION ORGANISATION - INTELLIGENT TRANSPORT SYSTEMS & SERVICES EUROPE	Computer programming, consultancy and related activities	PRC	€ 8,961,954	3%

[65] https://trimis.ec.europa.eu/

Company	NACE category	Org type	Total project costs	% of funding from org type
VOLKSWAGEN AG	Manufacture of motor vehicles, trailers and semi-trailers	PRC	€ 8,885,866	3%
CENTRO RICERCHE FIAT SCPA	Scientific research and development	REC	€ 9,803,625	9%
NEDERLANDSE ORGANISATIE VOOR TOEGEPAST NATUURWETENSCHAPPELIJK ONDERZOEK TNO	Scientific research and development	REC	€ 7,756,727	7%
DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV	Scientific research and development	REC	€ 7,473,054	7%
Teknologian tutkimuskeskus VTT Oy	Scientific research and development	REC	€ 6,915,279	6%
FONDATION PARTENARIAL MOV'EOTEC	Scientific research and development	REC	€ 6,309,849	6%
TECHNISCHE UNIVERSITEIT EINDHOVEN	Education	HES	€ 6,364,292	8%
CHALMERS TEKNISKA HOEGSKOLA AB	Education	HES	€ 4,697,702	6%
RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN	Education	HES	€ 4,265,163	5%
UNIVERSITY OF LEEDS	Education	HES	€ 3,510,024	4%
POLYTECHNEIO KRITIS	Education	HES	€ 2,881,875	4%
TRANSPORTS PUBLICS GENEVOIS	Land transport and transport via pipelines	PUB	€ 2,912,500	23%
GEMEENTE HELMOND	Public administration and defence; compulsory social security	PUB	€ 1,376,250	11%
DIENST WEGVERKEER (RDW)	Public administration and defence; compulsory social security	PUB	€ 650,730	5%
CENTRE D ETUDES ET D EXPERTISE SUR LES RISQUES L ENVIRONNEMENT LA MOBILITE ET L AMENAGEMENT	Public administration & defence; social security	PUB	€ 639,759	5%
COMUNE DI MODENA	Public administration & defence; social security	PUB	€ 558,375	4%

Company	NACE category	Org type	Total project costs	% of funding from org type
FUNDINGBOX ACCELERATOR SP ZOO	Activities of head offices; management consultancy activities	OTH	€ 2,791,313	23%
FEDERATION INTERNATIONALE DE L'AUTOMOBILE	Other service activities	OTH	€ 1,561,019	13%
ASSOCIATION EUROPEENNE DES FOURNISSEURS AUTOMOBILES	Activities of head offices; management consultancy activities	OTH	€ 1,285,625	11%
POLIS - PROMOTION OF OPERATIONAL LINKS WITH INTEGRATED SERVICES, ASSOCIATION INTERNATIONALE	Activities of membership organisations	OTH	€ 980,368	8%
SAMFUNNS-OG NAERINGSLIVSFORSKNING AS	Scientific research and development	OTH	€ 875,250	7%

The total project cost according to country of organisation is shown in Figure 66 below. Germany (DE) took the significant proportion of project costs at 28% (€ 151M). France was next highest at 10% (€52M).

Figure 66: CCAM H2020 projects by country

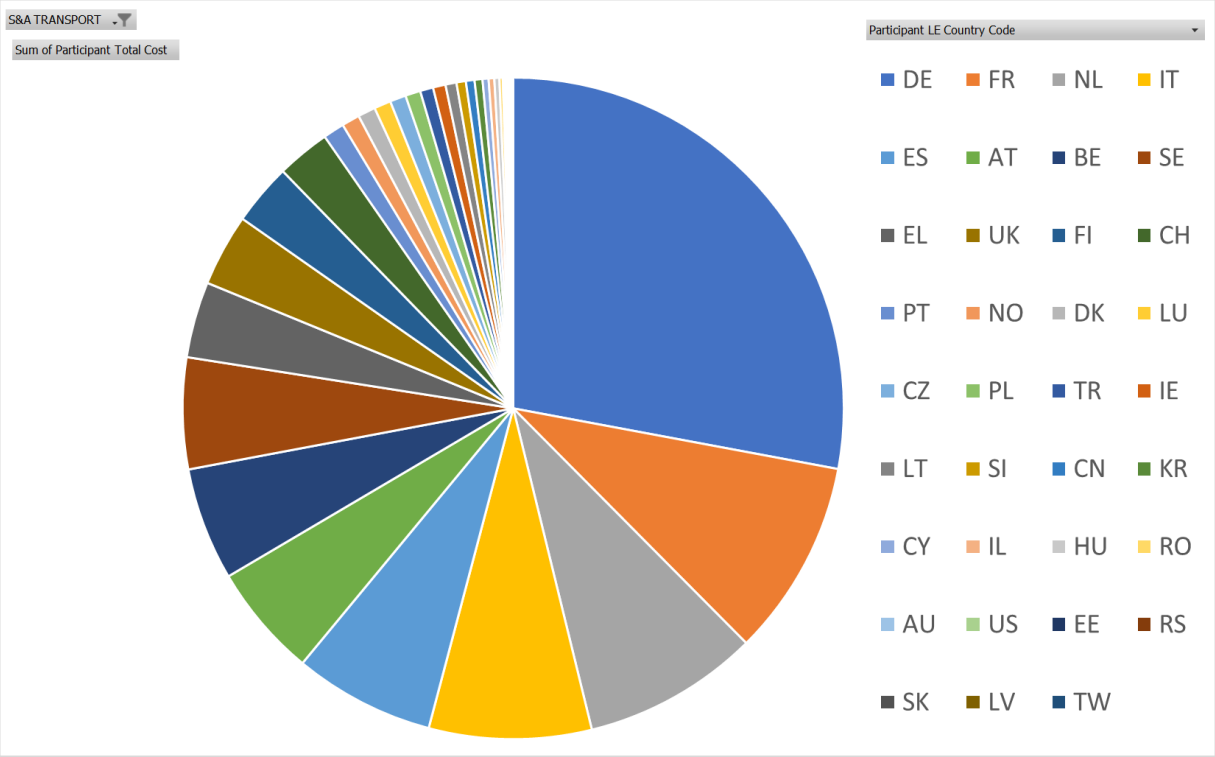


Table 53 shows the types of stakeholders participating in the H2020 projects. These are categorised by the NACE categorisation. The table shows a diverse range of actors in the field, with 43 different NACE sub-categories of organisations contributing. These include manufacturing, information & communication, and mining & quarrying.

Table 53: Participant NACE categorisation of H2020 projects

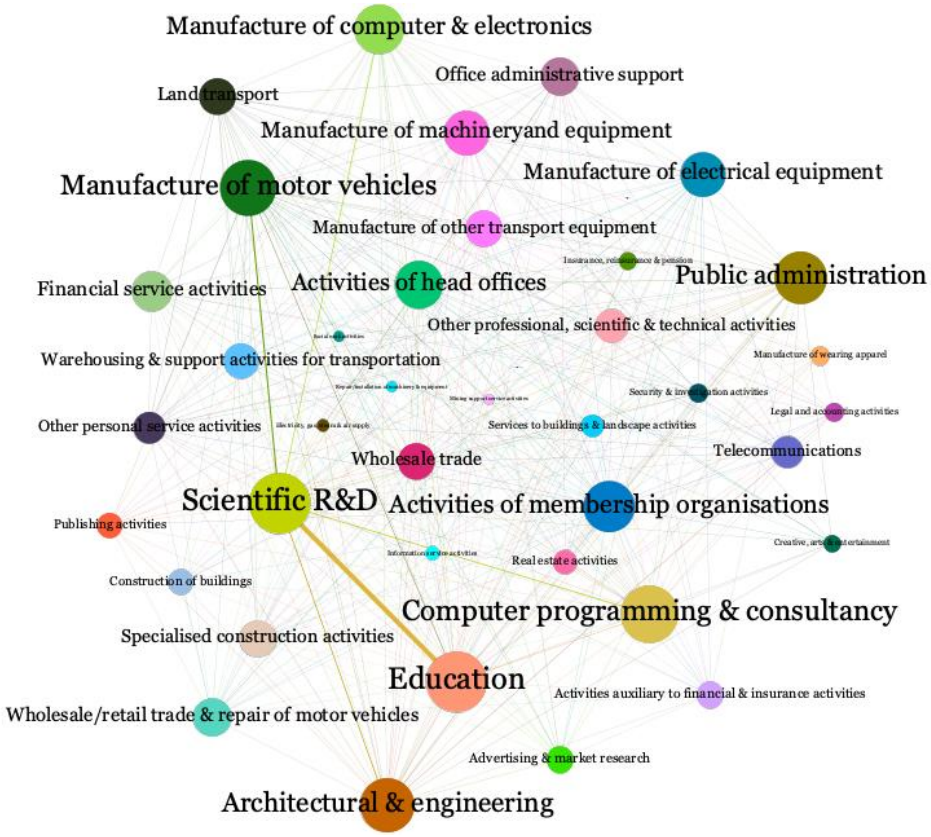
NACE categorisation	Participant Total Project Cost
Prof., S&T activities	**€ 169,904,576**
Scientific research and development	€ 124,197,691
Architectural and engineering activities; technical testing and analysis	€ 30,798,500
Activities of head offices; management consultancy activities	€ 8,275,495
Other professional, scientific and technical activities	€ 6,270,514
Legal and accounting activities	€ 218,750
Advertising and market research	€ 143,625
Manufacturing	**€ 151,693,363**
Manufacture of motor vehicles, trailers and semi-trailers	€ 75,942,770
Manufacture of computer, electronic and optical products	€ 50,669,314
Manufacture of machinery and equipment n.e.c.	€ 16,039,698
Manufacture of electrical equipment	€ 5,308,804
Manufacture of other transport equipment	€ 2,579,161
Repair and installation of machinery and equipment	€ 736,758
Manufacture of wearing apparel	€ 274,000
Manufacture of fabricated metal products, except machinery and equipment	€ 71,429
Other manufacturing	€ 71,429
Education	**€ 76,725,111**
Education	€ 76,725,111
Information and communication	**€ 55,889,746**
Computer programming, consultancy and related activities	€ 44,695,256
Telecommunications	€ 10,600,365
Information service activities	€ 367,875
Publishing activities	€ 226,250
n/a	**€ 39,995,970**
n/a	€ 39,995,970
Other service activities	**€ 10,533,806**
Activities of membership organisations	€ 4,232,576
Other service activities	€ 3,409,834
Other personal service activities	€ 2,891,397

NACE categorisation	Participant Total Project Cost
Transportation & storage	**€ 10,114,052**
Land transport and transport via pipelines	€ 5,800,563
Warehousing and support activities for transportation	€ 4,313,490
Public administration & defence; social security	**€ 8,729,699**
Public administration and defence; compulsory social security	€ 4,964,221
Public administration & defence; social security	€ 3,765,478
Wholesale & retail trade	**€ 8,673,597**
Wholesale and retail trade and repair of motor vehicles and motorcycles	€ 5,048,058
Wholesale trade, except of motor vehicles and motorcycles	€ 3,625,539
Construction	**€ 4,481,934**
Specialised construction activities	€ 4,269,934
Construction of buildings	€ 212,000
Administrative & support service activities	**€ 1,952,414**
Office administrative, office support and other business support activities	€ 1,254,077
Services to buildings and landscape activities	€ 626,588
Security and investigation activities	€ 71,750
Financial & insurance activities	**€ 1,841,200**
Financial service activities, except insurance and pension funding	€ 1,208,107
Insurance, reinsurance and pension funding, except compulsory social security	€ 326,580
Activities auxiliary to financial services and insurance activities	€ 306,513
Mining & quarrying	**€ 862,959**
Mining support service activities	€ 862,959
Electricity, gas, steam & air conditioning supply	**€ 623,000**
Electricity, gas, steam and air conditioning supply	€ 623,000
Real estate activities	**€ 514,250**
Real estate activities	€ 514,250
Arts, entertainment & recreation	**€ 463,750**
Creative, arts and entertainment activities	€ 463,750
Human health and social work activities	**€ 87,688**
Social work activities without accommodation	€ 87,688

NACE categorisation	Participant Total Project Cost
Grand Total	**€ 543,087,113**

The social network analysis for previous projects related to Safe and Automated Road Transport funded under Horizon 2020 is shown in Figure 67 and Figure 68. The graph shows the network of industries participating in the projects that the European Commission officially indicated as belonging to the field of automated road transport,[66] according NACE classification.[67] Each circle represents a type of industry and a connecting line signifies collaboration within project(s), a thicker line shows that the industries have worked together in more projects.

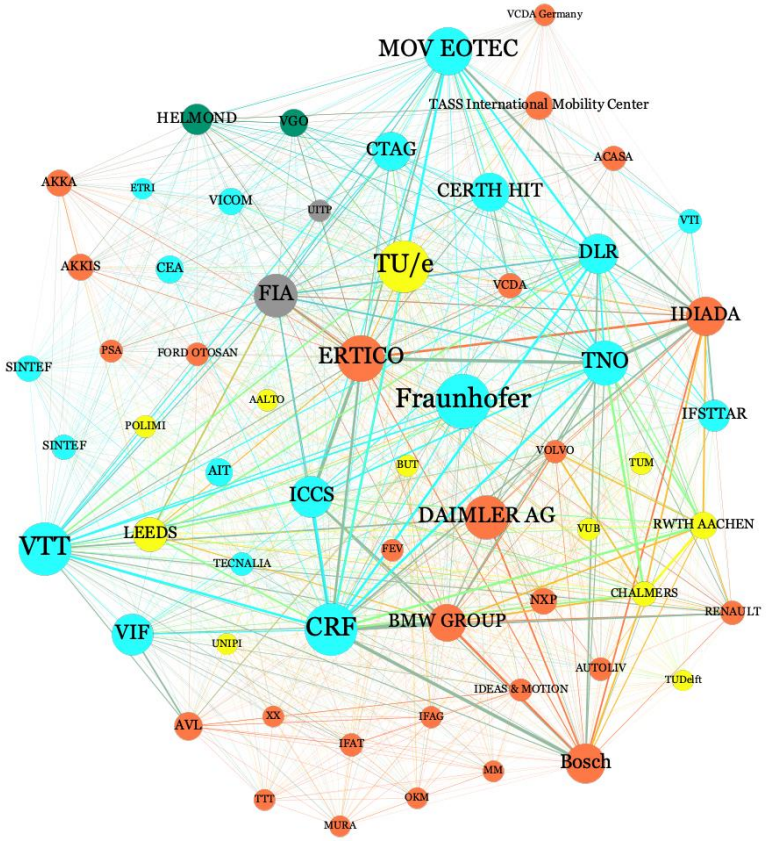
Figure 67: SNA of projects officially indicated as belonging to the field of 'automated road transport'



[66] In the TRIMIS database as related to connected automated transport – road transport

[67] The NACE codes were matched by DG RTD using ORBIS. Please note that not all participants were matched to a NACE code.

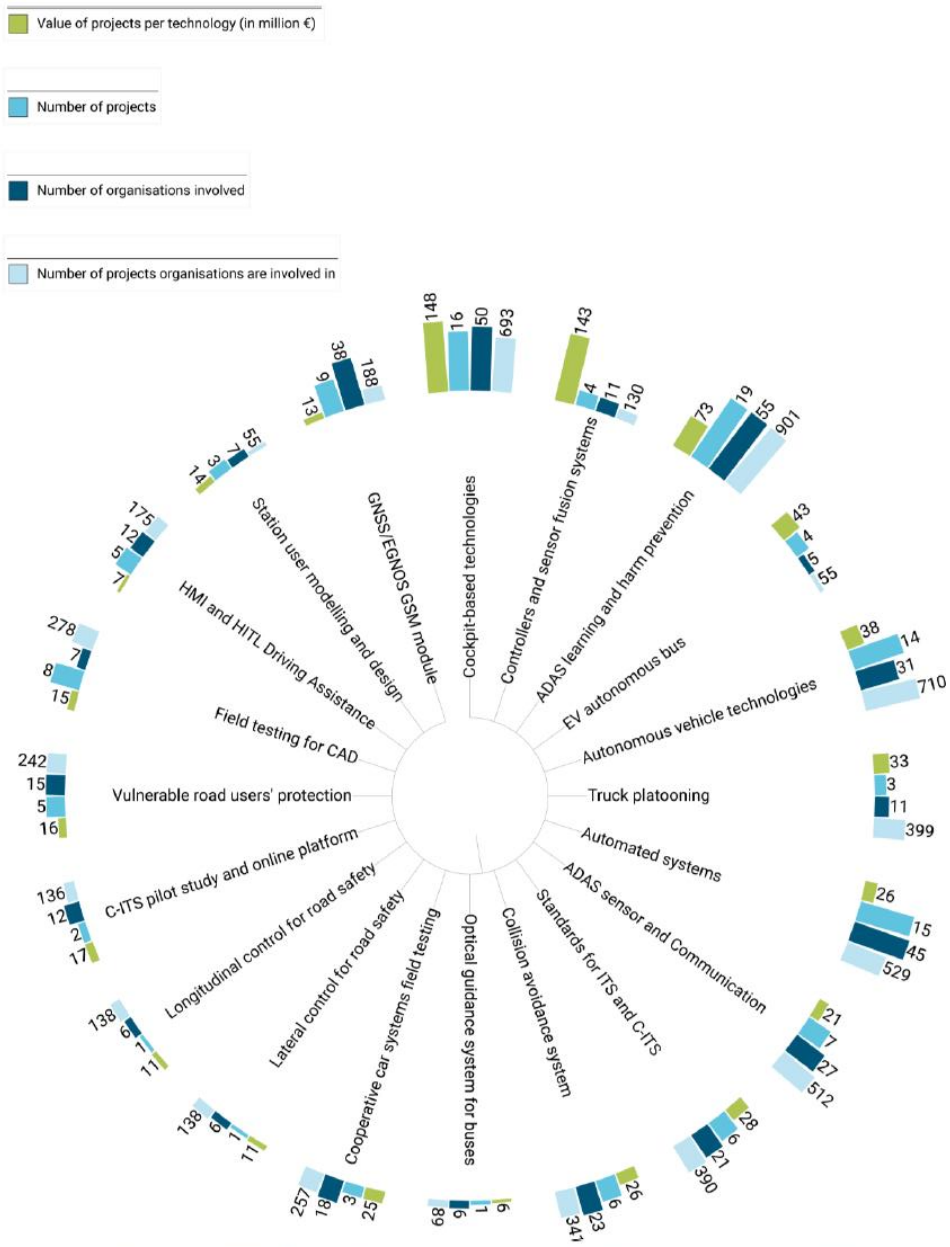
Figure 68: H2020 CCAM SNA by organisation



In a recent report from the JRC[68] some supplementary research was undertaken on H2020 projects associated with connected and automated transport in Europe. Figure 69 below shows a breakdown of framework programme projects by CAT technology, participants and value. Figure 70 overleaf shows the development phases of the Top 10 researched CAT technologies in FPs.

[68] European Commission, "Research and innovation in connected and automated transport in Europe," 2019. [Online]. Available: https://publications.jrc.ec.europa.eu/repository/bitstream/JRC118270/jrc118270_20191213_cat_report_online_final.pdf. [Accessed 23 01 2020].

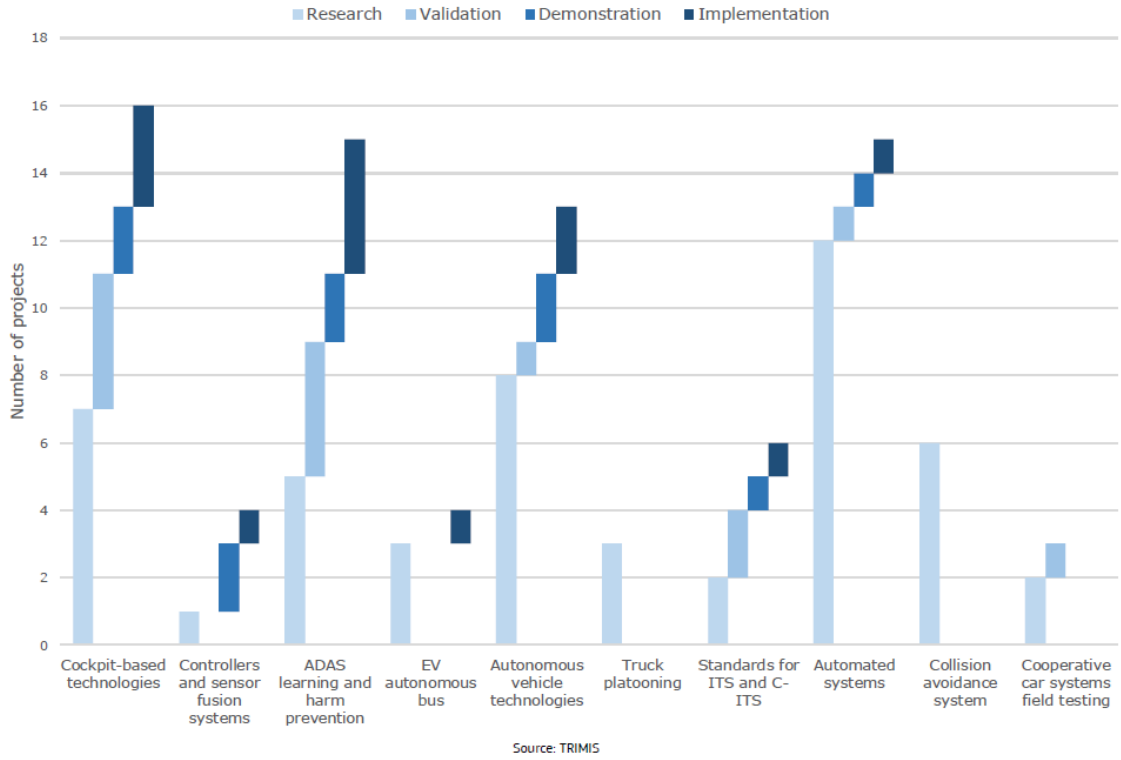
Figure 69: Top 20 CAT technologies in the framework programme by value and participants.



Bars not in scale. Abbreviations: ADAS - Advanced driver-assistance systems; ITS - Intelligent Transport Systems; C-ITS - Coopera Intelligent Transport Systems; CAD – Connected and Automated Driving; HMI – Human Machine Interface HITL - Hardware-in-the-L GNSS - Global Navigation Satellite System; EGNOS - European Geostationary Navigation Overlay Service; GSM - Global System Mobile Communications.

Source: TRIMIS

Figure 70: Development phases of the Top 10 researched CAT technologies in FPs



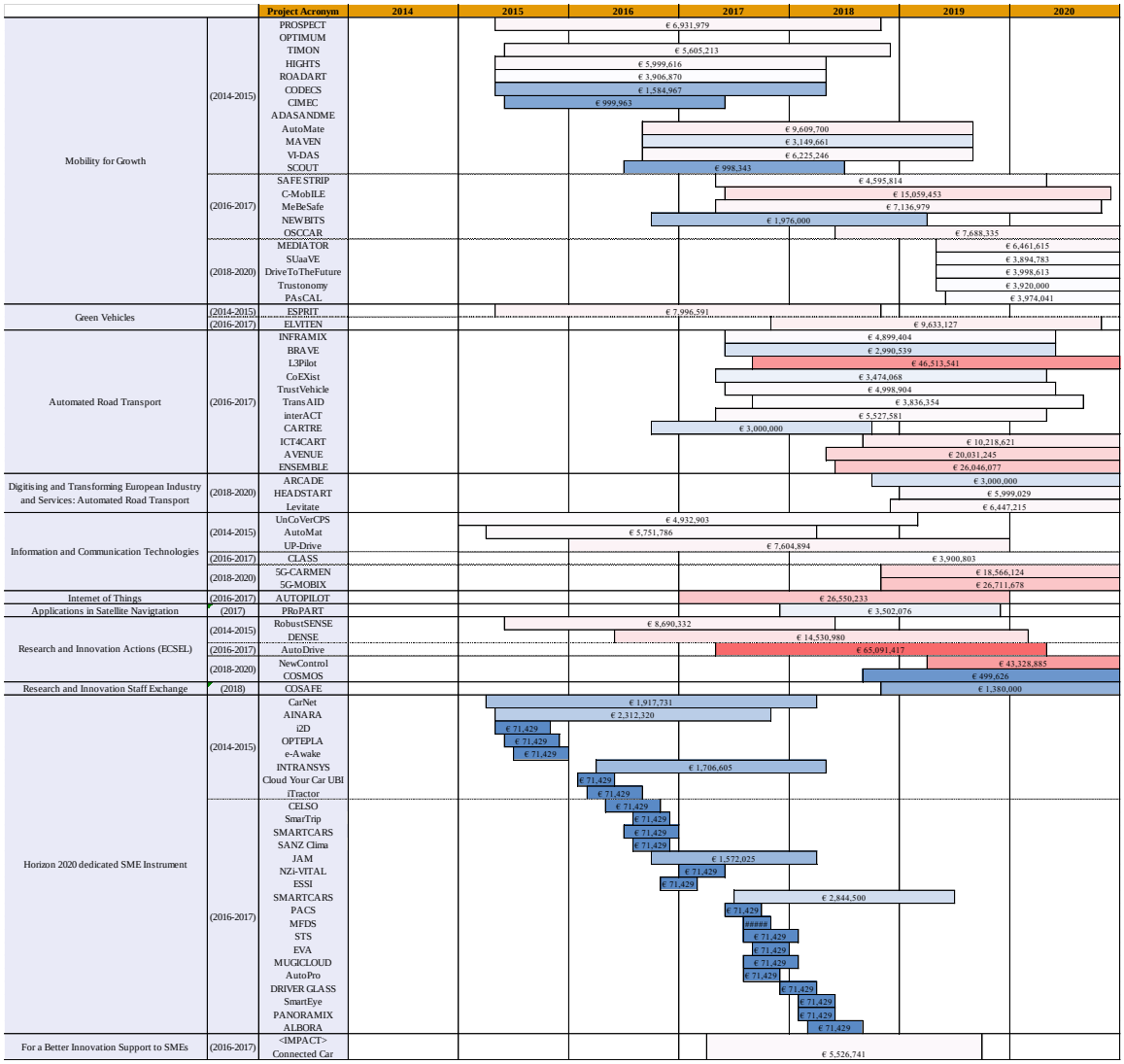
The call topic ID for each CCAM H2020 project in the eCorda database has been used to identify the topics, calls, work programmes and focus areas under which projects relating to CCAM have been funded. These are shown in Figure 71. The individual call titles are written in blue, for some the same title has been used over multiple years in which case the call title has only been written once. Each call comes under a work programme, the work programme titles/topics are shown in the circles that are connected to the calls. The higher-level structure (also in circles) has been based on the layout of sections given on the Horizon 2020 website[69]. In the grey text are the topics under which the projects have been funded, these more detailed elements give a clearer idea of the scope and objectives of previous research under H2020.

[69] https://ec.europa.eu/programmes/horizon2020/h2020-sections

Figure 71: CCAM H2020 funding calls

The budget and timeline for individual H2020 CCAM projects are shown in Figure 72.

Figure 72: CCAM H2020 project programme



D.9 Value Chain from GEAR 2030 Final Report

According to GEAR 2030's final report on the automotive competitiveness and sustainable growth in the automotive industry in the EU,[70] the European automotive sector is expected to undergo profound structural changes in its value chain due to shifts towards low emission mobility through deployment of alternative power trains and development of digital technologies resulting in a move to connected and automated transport. The report also notes that industries are becoming increasingly integrated in global value chains.

[70] GEAR 2030, "Final Report of High Level Group on the Competitiveness and Sustainable Growth of the Automotive Industry in the EU," 18 October 2017. [Online]. Available: https://ec.europa.eu/growth/content/high-level-group-gear-2030-report-on-automotive-competitiveness-and-sustainability_en. [Accessed 20 September 2019].

Figure 73: Automotive value chain and factors that are likely to lead to changes

The value chain begins with the extraction of raw materials. At the component level, the move to digitisation, along with a shift to greener vehicles is resulting in a wider range of materials required, in particular a growing demand for rare metals.

Design and production (suppliers): 3,000 EU companies across all member states, ranging from SMEs to multinational tier 1 suppliers belong to this section of the value chain, and €25bn out of €30bm spent annually on R&D in automotive industry is attributable to them. Additionally, electronic components make up for a third of the cost of a vehicle. The European digital value chain for the automotive sector is currently strong but is at risk if competitiveness is lost and there is lag in the shift to AV. There are also other important concerns in this area, such as intellectual property theft and industrial espionage, that need to be considered when spreading to third country markets.

Design and production (OEMs): Increasing automation and exchange of data (both V2V and V2I) will have consequences in this area. By 2020, most new vehicles are expected to have some basic AV features and data exchange capabilities, meaning consumer electronics and ICT companies will increasingly enter the value chain. This convergence of industries will be challenging due to the product life cycles are historically short within consumer electronics but long within the automotive sector. The two will need to meet in the middle, automotive industry may need to rapidly accelerate product cycles to remain competitive, but consumer electronics and ICT sectors will have to adapt for the testing and approval regime resulting from high demands on reliability and system lifetime in the automotive industry. Competitiveness of the car manufacturers may have a significant effect on other parts of the value chain, for example the suppliers, so work in this area is essential, this work is expected to include consideration of new business models.

Sales and distribution: Dealers will need to adapt to rapid evolution of the market and the availability of new products.

Consumption, use and reuse: As well as the end user, there is a large number and wide range of stakeholders and operators within this sector, including those involved with design of test equipment, vehicle inspection, workshops and retrofitting. Their position could be challenged by the increasing complexity of application of electronic systems.

Across all areas of the value chain, changes in job profiles as a result of evolving technology and processes will require employers to set aside resources for upskilling and retraining staff in order to ensure effectiveness.

While a shift to AVs requires digitalisation within products, the report highlights the importance of transformation towards digitalisation of the entire automotive value chain at all levels – processes, products and services. This process of migrating from traditional services to digital ones requires significant investments, particularly for SMEs. With the development and increasing use of automated vehicle functions, SMEs will also need to increase their capacity to integrate digital technologies in their products portfolio. Their position in the value chain will also need to be assessed and possibly redefined.

D.10 Strategic Value Chains and Important Projects of Common European Interest

In November 2019 the commission published "Strengthening Strategic Value Chains for a future ready EU industry", from the Strategic Forum for Important Projects of Common European Interest.[71] The objective of the Strategic Forum, which consists of 45 members representing Member States, industry and the research community, was to identify key strategic value chains in Europe and propose a common vision for joint actions and investments between EU, Member States and industry. The Forum analysed several European industrial value chains and selected six strategic value chains where further joint and coordinated efforts were needed. The six identified strategic value chains are:

- Connected, clean and autonomous vehicles;
- Smart health;
- Low-CO2 emission industry;
- Hydrogen technologies and systems;
- Industrial Internet of Things; and
- Cybersecurity.

The report identifies enabling actions for the six selected strategic value chains which range from joint investments, consolidation of Single Market through regulations and standards to development of new skills. It also calls for an agile governance process to monitor technological and industrial developments, to identify emerging strategic value chains and to monitor and evaluate the progress of work on these value chains.

The Connected, Clean and Autonomous Vehicles (CCAV) strategic value chain is of direct relevance to CCAM. Industrial Internet of Things and Cybersecurity are complimentary to CCAM. The actions for the Connected, Clean and Autonomous Vehicles are split into two areas: coordinated investments and related supporting actions. They are listed in Table 54 below accompanied by an indication of their relevance to the CCAM R&I agenda. Of the actions that are deemed highly relevant to the CCAM R&I agenda, further information is provided in Table 55.

There are strong linkages between the CCAV strategic value chain initiative and the CCAM R&I agenda, with complimentary and overlapping actions between the two, in particular facilitating and accelerating the pathway to greater deployment of CCAM solutions.

[71] European Commission, "Strengthening EU value chains for a future-ready EU industry," 05 11 2019. [Online]. Available: https://ec.europa.eu/docsroom/documents/37824/attachments/2/translations/en/renditions/native. [Accessed 23 01 2020].

Table 54: CCAV Strategic Value Chain Action Areas

Area	Topic	Action	Relevance to CCAM R&I agenda
Coordinated investments	**On-board components**	1. New generation high-efficiency electric motors	Low
		2.High-power inverters based on wide-band gap semiconductors	Low
		3. Hydrogen system for vehicles (storage + fuel cells)	Low
		4. Next generation tyres for connected, clean and autonomous vehicles	Low
	Infrastructure	5. High power charging stations	Low
		6. Vehicle-to-grid	Low
		7. Hydrogen refuelling stations	Low
	Application specific initiatives	8. Sustainable road transport ecosystem for heavy freight logistics	Medium
		9. Boost the adoption of clean and autonomous buses by municipalities	High
		10. Digital infrastructure to enable big data analytics and advanced AI for connected and autonomous driving	High
		11. Connected autonomous driving in real conditions	High
Related supporting actions	**Transversal**	12. Boost the development of the CCAV ecosystem with an "Accelerator Network" and a dedicated Investment Fund	High
		13. Accelerate the creation of a common European CCAV market through harmonization of frameworks, platforms and policies	High
		14. Encourage the transition to CCAV by end users and fleet operators with public policies, procurement, guidelines and incentives	Medium
		15. Support industrial deployment of new CCAV technologies	Medium
		16. Develop a highly skilled workforce in all parts of the CCAV value chain	Low

Table 55: Detailed description of highly relevant CCAV strategic value chain action areas. Bold indicates overlap with the CCAM R&I agenda.

Highly relevant action area	Further information
9. Boost the adoption of clean and autonomous buses by municipalities	Provide medium-scale procurement programs for deployment on the market (>100 buses per projects, 10 000 in total by 2025) for mature technologies **Provide small-scale pilot programs for research (>10 buses per projects, 1 000 in total by 2025) for innovative technologies (autonomous, wireless charging, other solutions…)** **Provide funding for R&D for clean and autonomous buses.** **Certification: create a dedicated quality standard with certification & training programs.** Coordinate investments for first industrialisation of innovative clean and autonomous buses, with a roadmap to reach EU manufacturing capabilities of 50 000 per year by 2030 Introduce a transitional subsidy scheme to encourage early adoption and allow the market to grow until it becomes economically sustainable. Create financing schemes to help Public Transport Authorities to finance the switch to clean/autonomous buses. Support best practices and twinning exercises between municipalities Support the review of the Directive on Alternative Fuels Infrastructure – hydrogen to become a mandatory target Support the review of the Industrial Emissions Directive – the concept of "chemical conversion on an industrial scale" should be defined in a manner which excludes the production of hydrogen via electrolysis in small quantities **Develop an appropriate regulatory framework to allow the deployment of fully autonomous buses**
10. Digital infrastructure to enable big data analytics and advanced AI for connected and autonomous driving	**Develop and apply a secure and cost-effective European digital infrastructure and back-end. This digital infrastructure could, for example, tackle challenges such as the massive amounts of data generated by CCAV as well as common European interfaces for infrastructures like traffic lights, traffic and transport management.** **Develop and deploy connected and autonomous driving communication and data infrastructure**
11. Deploy Connected autonomous driving in real conditions	**Ensure large-scale verification, validation and deployment of advanced automated driving systems and services for vehicles and fleets, embedded in mixed traffic scenarios in a selected number of countries, corridors or regions (potentially geo-fenced).** **Scale-up from demonstrator vehicles to large-scale pilots to speed-up deployment with thousands of automated vehicles to secure expected impact on the road system, drivers, users and society.** **Develop a common policy and instruments for connected & autonomous transport.**
12. Boost the development of the CCAV ecosystem with an "Accelerator Network"	Create a dedicated fund for CCAV within the European Fund for Strategic Investments

Highly relevant action area	Further information
and a dedicated Investment Fund	**Design and implement a specific platform aiming to facilitate match-making between CCAV companies and private investors** Create a "CCAV Accelerator" network of regional technology clusters ("CCAV Valleys"), based on a mapping of existing networks and initiatives Create dedicated strategic funding programs to help SMEs in CCAV in support of SME growth, cross-national collaboration and market consolidation in Europe. Develop and deploy "soft-financing" tools and programs that can bridge the funding gap between research and large-scale industrial deployment
13. Accelerate the creation of a common European CCAV market through harmonization of frameworks, platforms and policies	Establish a common regulatory framework for CCAV **Enhance the certification process of CCAV** **Define common standards to increase interoperability and competition along each layer of the MaaS value chain in Europe.** **Openly share data and information, while enforcing existing privacy regulation and standardization measures, in a platform open to all stakeholders and all transport modes.** **Coordinate ongoing testing of connected and automated mobility in accordance with the Single European Platform for Connected and Automated Mobility.** **Develop common standards for communication interface, data connection and storage between vehicles and users (infrastructure, customers) as a basis for governance of communication data flows** Develop an open and interoperable booking and payment solution, based on standards Create a European agency for CCAV and MaaS (Mobility as a Service) Introduce economic incentives for clean mobility and logistics for consumers/professionals + public procurement for heavy-duty vehicles.

D.11 Mappings against the CCAM R&I agenda

Based on the previous analysis this section presents different mappings against the CCAM R&I agenda (presented in Table 50). These mappings are used in later sections of the study.

Table 56 presents the key actors likely to be involved in the delivery of the future CCAM R&I agenda. There are four "categories" of organisation, and within each category a number of different types of organisation. Each type of organisation could be classed as different types of legal entity, i.e. Public, Private or Para-Public. An assessment of the organisation type's contribution to the three different aspects of the CCAM R&I agenda is also presented (as either "High" or "Low").

Table 56 shows a high reliance on the private and research sector to deliver against the Technology development R&I activities, with the public sector and representative bodies

having a greater role in the service design, demonstration and impact area. Public, Private and Research organisations all have a key role to play in R&I integration activities.

Figure 74 builds on Table 56 and shows an assessment of the mapping between the CCAM actors and the more detailed CCAM R&I action areas. The organisations with the greatest number of roles across R&I action areas are the vehicle industry, research institutes and higher education sector all with 22 mappings. The companies with the "strongest" linkages are the vehicle industry with 15. This is far higher than any other company type.

Figure 75 shows an assessment of the mapping between the CCAM H2020 projects and the CCAM R&I action areas. The data is summarised in Figure 76: 80 H2020 projects are mapped in total. The CCAM R&I action area with the most H2020 projects linked to it was Connectivity / cooperative systems with 37 mappings. This represents some of the closer to market and deployable CCAM solutions including both Day 1 and Day 1.5 C-ITS services. The lowest CCAM R&I category was Workforce development which was only addressed by one H2020 project (MAVEN).

Figure 77 shows other initiatives, outside of CCAM R&I, with weak or strong linkages to CCAM mapped against the CCAM R&I scope. There are strong links between the high-performance computing and key digital technologies initiatives with 2 and 4 strong links respectively. Smart networks and services, 2Zero also score highly overall with a number of weak linkages.

Table 56: Categorisation and types of key actors likely to be involved in the initiative

Categorisation	Type	Possible legal entity			Contribution to CCAM R&I agenda		
		Public	Private	Para-public	Technology development	Service design, demo & impact	R&I integration
Public	Member States	☐				Med	High
	Municipality and city authorities	☐				High	Med
	Road Authorities	☐				High	High
	Public Transport authorities or companies	☐	☐	☐		High	
	Regulatory/Certification/Legislation Authorities	☐					Med
Private	Vehicle industry		☐		High	High	High
	Other supporting technological industries		☐		High	Med	Med
	Breakdown, support, repair etc		☐			Med	
	Telecom network operators		☐		High	Med	Med
	ITS solution providers		☐		Med		Med
	Other transport and logistics companies		☐		Med	Med	
	Insurance and legal companies		☐			Med	
Research	Research institutes	☐	☐	☐	High	High	High
	Higher education sector	☐			High	High	High
Representative bodies	Road safety		☐			Med	
	Emergency Services	☐				Med	
	Mobility Consumers, NGOs, Workforce representatives, Entities representing road users, Social Networks, Real Estate Owners		☐			Med	

Figure 74: Mapping of CCAM R&I actions against actors. Strong role shown in dark orange, medium role shown in light orange. Probable low or no role shown as blank.

	CCAM R&I activity	Member states	Municipality and city authorities	Road Authorities	Public transport companies	Regulatory/Certification/Legislation Authorities	Vehicle industry	Other supporting technological industries	Breakdown, support, repair etc	Telecom network operators	ITS solution providers	Other transport and logistics	Insurance companies	Research institutes	Higher education sector	Road safety	Emergency services	Mobility consumers	NGOs	workforce representatives	Entities representing road users	Social networks	Real estate owners	Total weak links	Total strong links	Total links
Technological development	Environment perception																							4	1	**5**
	Cyber-secure Electronics																							4	1	**5**
	Passive and active safety for CCAM																							4	2	**6**
	On-board decision making																							6	1	**7**
	Vehicle validation																							7	4	**11**
	Vehicle-user interaction																							4	3	**7**
	Tele-operation																							6	2	**8**
	Physical and digital infrastructure (PDI)																							6	3	**9**
	Connectivity																							4	3	**7**
	Artificial Intelligence																							5	1	**6**
Service design , demonstration and impact	Fleet and mixed traffic management																							8	4	**12**
	Shared automated mobility solutions																							10	4	**14**
	Large-scale demonstration of highly automated passenger cars																							8	4	**12**
	Large-scale demonstration pilots of automated commercial/freight																							9	4	**13**
	Societal needs analysis																							9	3	**12**
	Socio-economic and Environmental impact analysis																							7	5	**12**
	Workforce development																							3	7	**10**
R&I coordination and integration	Strategic European agenda for R&I and large-scale testing																							20	0	**20**
	European framework for safe testing																							13	3	**16**
	Data exchange framework in the context of cross-border testing																							13	0	**13**
	EU-wide knowledge base, including common scenario database																							20	0	**20**
	Common evaluation framework																							20	0	**20**
	Data storage and sharing																							5	4	**9**
	Total weak links	13	9	7	8	12	7	11	5	10	11	9	12	20	20	12	4	7	6	6	6	6	8	**195**		
	Total strong links	4	8	8	6	1	15	0	0	4	0	2	0	2	2	6	0	0	0	1	0	0	0		**59**	
	Total links	**17**	**17**	**15**	**14**	**13**	**22**	**11**	**5**	**14**	**11**	**11**	**12**	**22**	**22**	**18**	**4**	**7**	**6**	**7**	**6**	**6**	**8**			**254**

Figure 75: CCAM H2020 project mapping to CCAM platform R&I activity areas

H2020 acronym	Environment perception	Cyber-secure electronics	Passive and active safety for CCAM	On-board decision making	Vehicle validation	Human-machine interaction and interface design	Remote operation	Physical and digital infrastructure	Connectivity/ cooperative systems	Artificial intelligence	Smart, shared automated mobility solutions	Fleet and (mixed) traffic management	Demonstration of shared automated mobility solutions	Demonstration of highly automated passenger vehicles	Large-scale demonstration pilots of automated HGVs	Societal needs analysis	Socio-economic impact assessment	Strategic European agenda for R&I and large-scale testin	European framework for testing on public roads	Data exchange framework	EU-wide knowledge base	Common evaluation framework and KPIs	Data storage and sharing	Workforce development	Total
PROSPECT	■					■					■			■		■					■				6
OPTIMUM		■							■					■	■								■		5
TIMON					■				■	■						■							■		5
HIGHTS				■				■	■																3
ROADART								■	■						■										3
CODECS																■				■					2
CIMEC		■										■				■									3
ADASANDME	■				■	■		■	■					■	■										7
AutoMate		■	■			■			■												■				5
MAVEN									■			■		■			■							■	5
VI-DAS	■		■	■		■			■												■		■		7
SCOUT											■	■				■			■			■			5
SAFE STRIP			■					■	■					■		■									5
C-MobILE					■						■							■		■		■			5
MeBeSafe						■			■					■											3
NEWBITS											■					■		■				■			4
OSCCAR			■		■	■						■		■							■				6
MEDIATOR	■		■		■	■				■							■								6
SUaaVE	■			■	■						■	■				■	■								7
DriveToTheFuture					■					■				■	■	■					■				6
Trustonomy			■	■	■	■								■	■	■									7
PAsCAL					■	■					■					■	■								5
ESPRIT												■		■			■								3
ELVITEN		■						■				■		■	■	■									6
INFRAMIX			■		■			■				■													4
BRAVE	■					■					■					■	■								5
L3Pilot														■	■	■	■	■				■	■		7
CoEXist					■			■				■					■								4
TrustVehicle	■	■	■		■	■		■						■	■						■				9
TransAID								■	■			■		■	■										5
interACT	■				■			■						■			■				■				6
CARTRE												■				■					■				3
ICT4CART		■							■					■									■		4
AVENUE		■	■					■							■										4
ENSEMBLE			■												■	■	■		■		■				6
ARCADE												■				■		■			■	■			5
HEADSTART					■									■	■	■			■		■	■			6
Levitate					■							■				■	■				■	■			6
UnCoVerCPS			■		■			■																	3
AutoMat		■																					■		2
UP-Drive	■			■																	■		■		4
CLASS		■						■	■					■									■		5
5G-CARMEN		■						■	■		■						■			■	■				7
5G-MOBIX								■	■					■		■				■					5
AUTOPILOT	■	■	■	■				■	■					■											7
PRoPART	■	■		■				■	■														■		6
RobustSENSE	■		■	■					■																4
DENSE	■								■																2
AutoDrive		■	■																			■	■		4
NewControl	■	■	■					■						■	■	■									7
COSMOS																	■	■			■				3
COSAFE		■	■						■	■											■		■		6
CarNet											■												■		2
AINARA		■									■			■	■										4
i2D		■	■								■	■											■		5
OPTEPLA				■			■		■														■		4
e-Awake				■																					1
INTRANSYS									■			■											■		3
Cloud Your Car UBI		■							■														■		3
iTractor	■			■			■		■																4
CELSO		■									■	■				■							■		5
SmarTrip		■																					■		3
SMARTCARS			■						■							■									3
SANZ Clima		■							■						■										3
JAM									■	■															2
NZi-VITAL						■			■																2
ESSI									■														■		2
SMARTCARS			■						■							■									3
PACS				■					■																2
MFDS								■	■														■		4
STS		■				■										■							■		4
EVA	■					■		■								■									4
MUGICLOUD		■							■			■											■		4
AutoPro		■							■							■									3
DRIVER GLASS	■					■										■									3
SmartEye	■		■											■	■										4
PANORAMIX		■	■								■	■				■									5
ALBORA	■	■							■	■				■		■									6
<IMPACT> Connected Car								■	■							■									3
	19	26	21	12	16	15	2	21	37	6	13	18	0	24	16	32	13	5	3	4	15	8	22	1	

Figure 76: Number of projects under Horizon 2020 covering each of the research and innovation action areas recommended by the CCAM platform

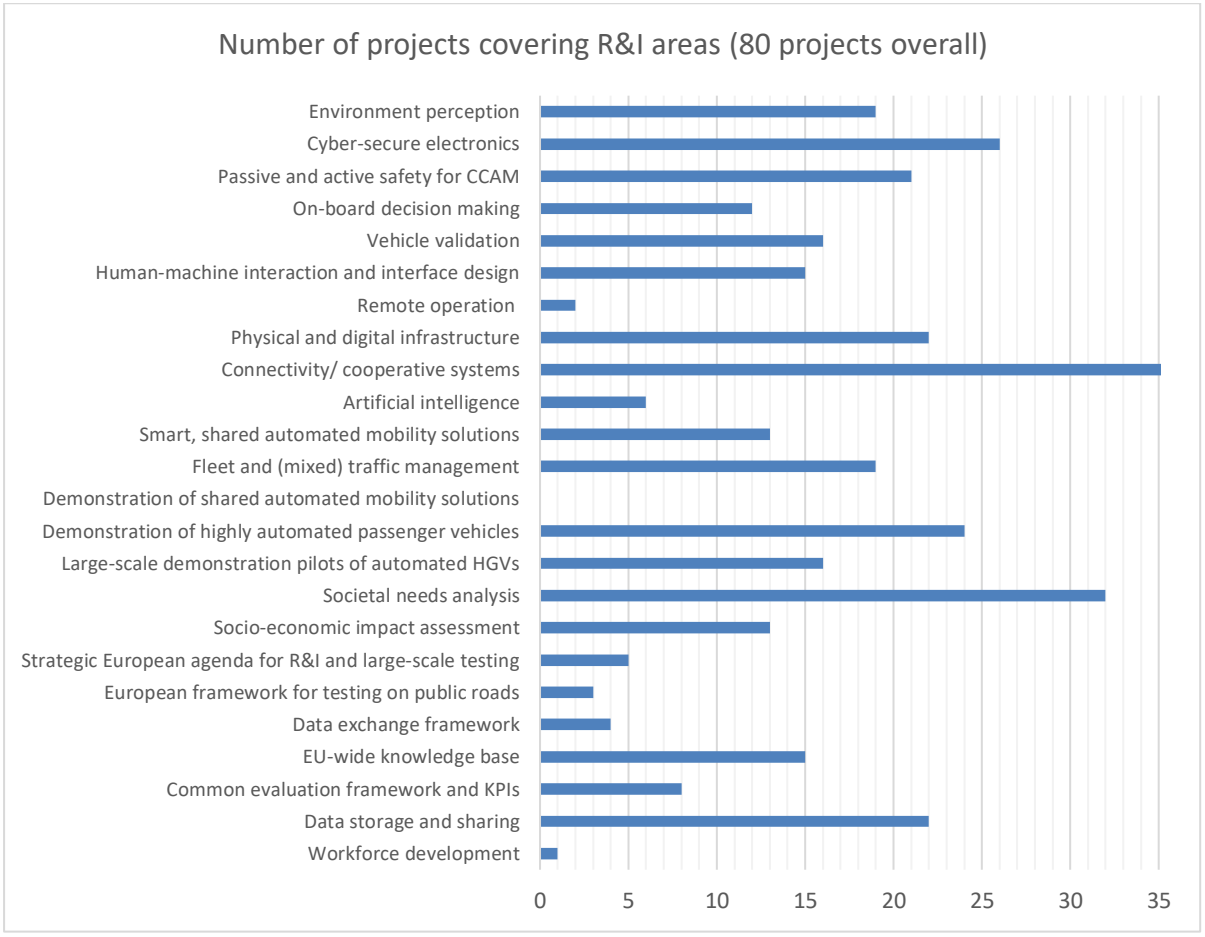


Figure 77: Other initiatives with weak (light orange) or strong (dark orange) linkages to CCAM mapped against CCAM R&I scope

CCAM R&I activity	High performance computing	Key Digital Technologies	Smart Networks and Services	AI, data, robotics	Photonics Europe	Global competitive space systems	Transforming Europe's rail system	Towards zero-emission road transport (2ZERO)	Batteries	Innovative SMEs	ITS Directive	CEF Transport	CEF Digital (incl. 5G corridors)	TEN-T guidelines (under evaluation)	Total weak links	Total strong links	Total links
Environment perception															2	1	**3**
Cyber-secure Electronics															0	1	**1**
Passive and active safety for CCAM															0	0	**0**
On-board decision making															0	3	**3**
Vehicle validation															0	1	**1**
Vehicle-user interaction															0	0	**0**
Tele-operation															1	2	**3**
Physical and digital infrastructure (PDI)															2	2	**4**
Connectivity															2	2	**4**
Artificial Intelligence															3	1	**4**
Smart, shared, automated mobility solutions															1	0	**1**
Governance															2	0	**2**
Large-scale demonstration of e-shuttle pilots															2	0	**2**
Large-scale demonstration of highly automated passenger cars															2	0	**2**
Large-scale demonstration pilots of automated commercial/HDVs															2	0	**2**
Societal needs analysis															1	0	**1**
Socio-economic and Environmental impact analysis															3	0	**3**
Strategic European agenda for R&I and large-scale testing															0	0	**0**
European framework for safe testing															0	0	**0**
Data exchange framework in the context of cross-border testing															1	0	**1**
EU-wide knowledge base, including common scenario database															0	0	**0**
Common evaluation framework															0	0	**0**
Data storage and sharing															1	0	**1**
Workforce development															0	1	**1**
Total weak links	3	2	4	2	1	0	3	6	1	1	0	0	0	2	**25**		
Total strong links	2	4	2	1	0	1	0	0	0	1	1	1	1	0		**14**	
Total links	**5**	**6**	**6**	**3**	**1**	**1**	**3**	**6**	**1**	**2**	**1**	**1**	**1**	**2**	**6**	**2**	**39**

Appendix E Additional information related to the policy options descriptions

Degree of coverage of the different functionalities by policy option

Table 57: Type and composition of actors (including openness and roles)

Option 0: Horizon Europe calls	Option 2: Co-funded	Option 3: Institutionalised Art 185	Option 1: Co-programmed	Option 3: Institutionalised Art 187
What is possible? *Any legal entity* in a consortiu**m** can apply to Horizon Europe calls in ad hoc combinations Calls are open to participation from across Europe and the world (not all entities from third countries are eligible for funding)	***What is possible?*** Partners can include *any national funding body or governmental research organisation*, Possible to include also *other type of actors*, including foundations.	***What is possible?*** Partners can include *MS and Associated Countries*.	***What is possible?*** Suitable for *all types of partners*: private and/or public partners, including MS, regions, foundations. By default open to AC/ 3rd countries, but subject to policy considerations. Can cover a *large and changing community.* HE rules apply by default to calls included in the FP Work Programme, so any legal entity can apply to these.	***What is possible?*** Suitable for *all types of partners*: private and/or public partners, including MS, foundations. By default open to legal entities from AC/ 3rd countries, but subject to policy considerations. In case of countries participating non-associated third countries can only be included as partners if foreseen in the basic act and subjected to conclusion of dedicated international agreements HE rules apply by default, so any legal entity can apply to partnership calls.
What is limited? Systematic/ structured engagement with public authorities, MS, regulators, standard making bodies, foundations and NGOs.	***What is limited?*** Requires substantial national R&I programmes (competitive or institutional) in the field. Usually only legal entities from countries that are part of the consortia can apply to calls launched by the	***What is limited?*** Non-associated third countries can only be included as partners if foreseen in the basic act and subjected to conclusion of dedicated international agreements. Needs good geographical coverage – participation of at least 40% of Member States is required	***What is limited?*** If MS launch calls under their responsibility, usually only legal entities from countries that are part of the consortia can apply to these, under national rules	***What is limited?*** Requires a *rather stable set of partners* (e.g. if a sector has small number of key companies). Basic act can foresee exceptions for participation in calls / eligibility for funding.

Option 0: Horizon Europe calls	Option 2: Co-funded	Option 3: Institutionalised Art 185	Option 1: Co-programmed	Option 3: Institutionalised Art 187
	partnership, under national rules.	Requires substantial national R&I programmes (competitive or institutional) in the field. While by default the FP rules apply for eligibility for funding/participation, in practice (subject to derogation) often only legal entities from countries that are Participating States can apply to calls launched by the partnership, under national rules.		
What is not possible? To have a joint programme of R&I activities between the EU and committed partners that is implemented based on a common vision.	***What is not possible?*** To have industry/ private sector as partners.	***What is not possible?*** To have industry/ private sector as partners.		

Table 58: Type and range of activities (including flexibility and level of integration)

Option 0: Horizon Europe calls	Option 2: Co-funded	Option 3: Institutionalised Art 185	Option 1: Co-programmed	Option 3: Institutionalised Art 187
What is possible? Horizon Europe standard actions that allow *broad range of individual activities* from R&I to TRL 7 or sometimes higher. Calls for proposals published in the Work Programmes of Horizon Europe (adopted via comitology).	***What is possible?*** Activities may range from R&I, pilot, deployment actions to training and mobility, dissemination and exploitation, but according to national programmes and rules. Decision and implementation by "beneficiaries" (partners in the co-fund grant agreement) e.g. through institutional funding programmes, or by "third parties" receiving financial support, following calls for proposals launched by the consortium.	***What is possible?*** Horizon Europe standard actions that allow a broad range of coordinated activities from R&I to uptake. In case of implementation based on national rules (subject to derogation) Activities according to national programmes and rules. Allows integrating national funding and Union funding into the joint funding of projects	***What is possible?*** *Horizon Europe standard actions* that allow a broad range of coordinated activities from R&I to uptake. The association representing private partners allows to continuously build further on the results of previous projects, including activities related to regulations and standardisation and developing synergies with other funds Union contribution is implemented via calls for proposals published in the Work Programmes of Horizon Europe based on the input from partners (adopted via comitology). Open and flexible form that is simple and easy to manage.	***What is possible?*** *HE standard actions* that allow to build a portfolio with broad range of activities from research to market uptake. The back-office allows dedicated staff to implement integrated portfolio of projects, allowing to build a "system" (e.g. *hydrogen*) via pipeline of support to accelerate and scale up the take-up of results of the partnership, including those related to regulations and standardisation and developing synergies with other funds. E.g. setting up biorefinery plants and promoting their replication by additional investments from MS/ private sector. Procuring/purchasing jointly used equipment (e.g. HPC) Allows integrating national funding and Union funding into the joint funding of projects
What is limited?	***What is limited?*** Scale and scope of the programme the resulting funded R&I actions and depend on the participating programmes, typically		***What is limited?*** Limited control over precise call definition, resulting projects and outcomes, as they are implemented by EC agencies.	***What is limited?*** Limited flexibility because objectives, range of activities and partners are defined in the Regulation, and negotiated in the Council (EP).

Option 0: Horizon Europe calls	Option 2: Co-funded	Option 3: Institutionalised Art 185	Option 1: Co-programmed	Option 3: Institutionalised Art 187
	smaller in scale than FP projects			
What is not possible? To design and implement in a systemic approach a portfolio of actions. To leverage additional activities and investments beyond the direct scope of the funded actions				

Table 59:Directionality

Option 0: Horizon Europe calls	Option 2: Co-funded	Option 3: Institutionalised Art 185	Option 1: Co-programmed	Option 3: Institutionalised Art 187
What is possible? Strategic Plan (as implementing act), annual work programmes (via comitology). Possible also to base call topics on existing or to be developed SRIA/roadmap	***What is possible?*** Strategic R&I agenda/roadmap agreed between partners and EC Annual work programme drafted by partners, approved by EC Objectives and commitments are set in the Grant Agreement.	***What is possible?*** Strategic R&I agenda/roadmap agreed between partners and EC Objectives and commitments are set in the legal base. Annual work programme drafted by partners, approved by EC Commitments include obligation for financial contributions (e.g. to administrative costs, from national R&I programmes).	***What is possible?*** Strategic R&I agenda/roadmap agreed between partners and EC Objectives and commitments are set in the contractual arrangement. Input to FP annual work programme drafted by partners, finalised by EC (comitology) Commitments are political/best effort, but usually fulfilled	***What is possible?*** Strategic R&I agenda/roadmap agreed between partners and EC Objectives and commitments are set in the legal base. Annual work programme drafted by partners, approved by EC (veto-right in governance) Commitments include obligation for financial contributions (e.g. to administrative costs, from national R&I programmes).
What is limited? No continuity in support of priorities beyond the coverage of the strategic plan (4 years) and budget (2 years Annual work programme).				
What is not possible? Coordinated implementation and funding linked to the concrete objectives/ roadmap, since part of overall project portfolio managed by agency				

Table 60: Coherence (internal and external)

Option 0: Horizon Europe calls	Option 2: Co-funded	Option 3: Institutionalised Art 185	Option 1: Co-programmed	Option 3: Institutionalised Art 187
What is possible? Coherence between different parts of the Annual Work programme of the FP ensured by EC	***What is possible?*** Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC Synergies with national/regional programmes and activities	***What is possible?*** Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC Synergies with national/regional programmes and activities Synergies with other programmes	***What is possible?*** Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC If MS participate: Synergies with national/regional programmes and activities Synergies with industrial strategies	***What is possible?*** Coherence among partnerships and with different parts of the Annual Work programme of the FP can be ensured by partners and EC Synergies with other programmes or industrial strategies If MS participate: Synergies with national/regional programmes and activities
What is limited? Synergies with other programmes or industrial strategies	***What is limited?*** Synergies with other programmes or industrial strategies	***What is limited?*** Synergies with industrial strategies	***What is limited?*** Synergies with other programmes	
What is not possible? Synergies with national/regional programmes and activities				

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