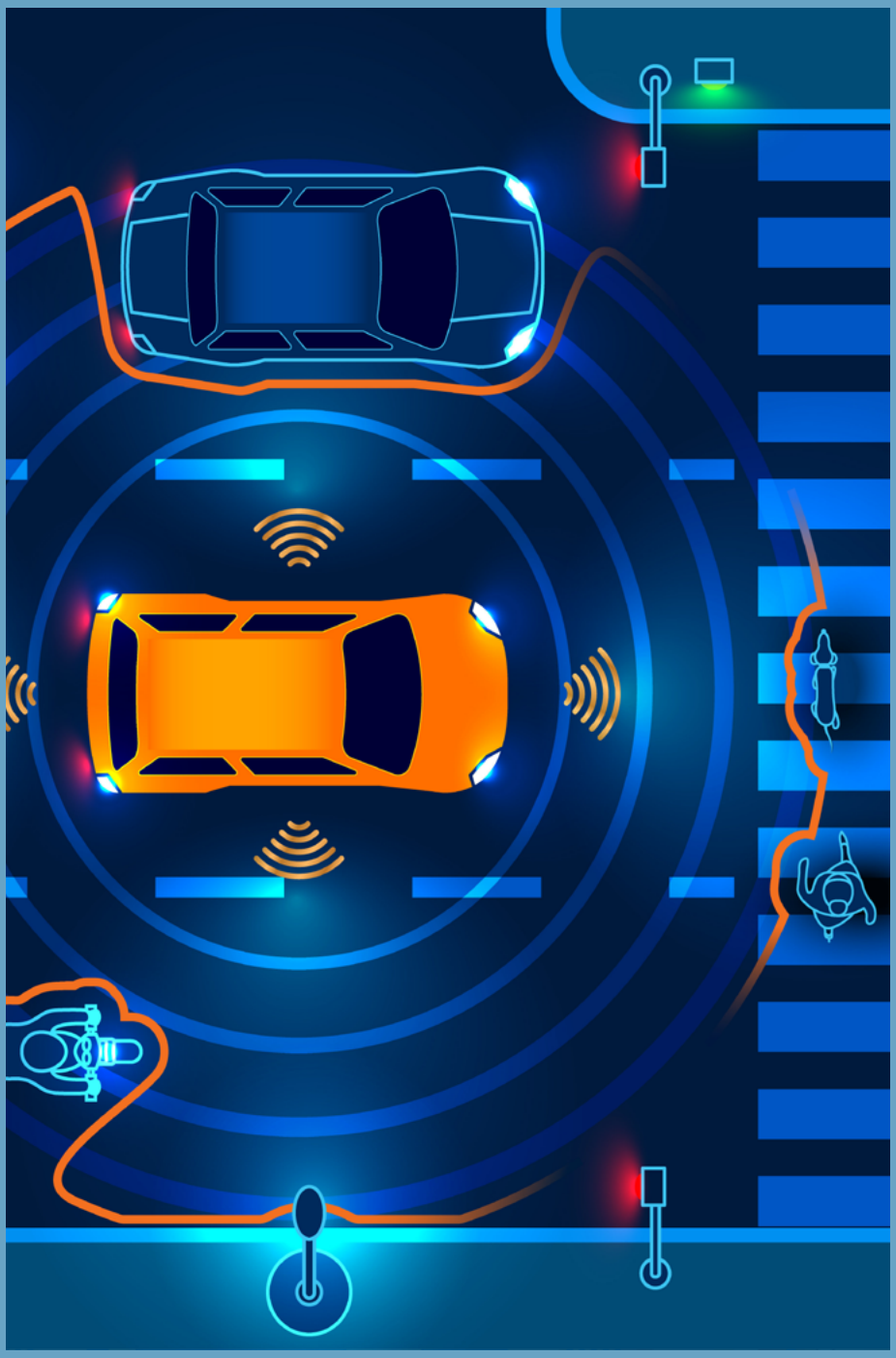

SRIA

STRATEGIC RESEARCH AND INNOVATION AGENDA

2021 - 2027

European leadership in safe and sustainable road transport through automation

CCAM

CONNECTED, COOPERATIVE & AUTOMATED MOBILITY

Co-funded by the European Union

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2. Preface

The CCAM (Connected Cooperative Automated Mobility) Partnership is a public private partnership, which aligns all stakeholders' R&I efforts to accelerate the implementation of innovative CCAM technologies and services in Europe. It aims to exploit the full systemic benefits of new mobility solutions enabled by CCAM: increased safety, reduced environmental impacts, and inclusiveness. The Partnership will develop and implement a shared, coherent and long-term R&I agenda by bringing together the complex cross-sectoral value chain actors with the joint vision: "European leadership in safe and sustainable road transport through automation".

This Strategic Research and Innovation Agenda (SRIA) is the multiannual roadmap, guiding the CCAM Partnership. It describes the CCAM Partnership strategy for achieving the expected impacts, the corresponding portfolio of activities, the resources, and timeline. It sets the Partnership's objectives and defines the process for identifying and prioritising the research and innovation activities needed to achieve these objectives.

The CCAM SRIA is the basis for the CCAM Partnership under the Horizon Europe Programme.

The following steps explain the CCAM SRIA co-creation process from January 2020 until finalisation:

1. Initiation of the Partnership Proposal drafting team, following the request for such a group expressed by EC representatives in the CCAM Single Platform WG 1 meeting, on 27th January 2020. The drafting team consisted of a wide range of European associations representing the different CCAM stakeholders.

2. Combination of inputs from recent strategic R&I recommendations, during the period November 2019 – February 2020, also including recent work by the CCAM Platform WG1.

3. Discussing aim, ambitions, vision and main R&I areas in a first Stakeholder workshop, on February 17th 2020, in Brussels, with about 140 participants. Interests of participants to contribute to the Partnership were collected at this occasion.

4. Publication of draft Proposal and online consultation to collect feedback, in mid-March 2020: with over 90 detailed responses received, brought in by various stakeholders across the value chain.

5. Final draft of Partnership Proposal sent to European Commission services on 13 April 2020 (with a revised version published on EC website on 13 May 2020[29]).

6. In April 2020, the SRIA preparation started as fully transparent and open process, allowing all interested stakeholders to contribute to the definition of the vision, objectives and R&I priorities in seven CCAM Clusters (see Chapter 7).

7. Presentation, exchange and discussion with the CCAM Platform WG 1 experts on the Clusters, R&I actions and priorities, in the WG 1 meeting of May 4th.

8. From May 18th to 20th 2020: stakeholders involvement through a series of 7 open online workshops, specifically to validate the orientations of the SRIA content. In these meetings, the current state of the art, the ambitions and the steps to be taken were outlined, discussed and sharpened. With around 70 participants per session and a dynamic interaction, followed-up by email exchanges, ample and in-depth knowledge and explanations were gathered.

9. On June 3rd 2020, a dedicated meeting was organised to inform Member States representatives from respective Ministries on the progress of the CCAM Partnership preparation and SRIA drafting, and in particular on the willingness to set up a Member States Advisory Board within the Partnership governance in order to ensure a regular consultation of national representatives.

10. Distribution of draft SRIA content to stakeholders mid-June, and from June 16th to 18th, second series of 7 open online workshops, to discuss in detail the R&I actions and validate them with the stakeholders.

11. In July, the draft SRIA was published online and distributed to the stakeholders.

12. From September 17th to 28th, a public consultation was organised over the R&I priorities proposed for the first Work Programme 2021-2022 of the Partnership, with circulation of a draft and collection of input.

13. In September and October, the new CCAM Association that will support the Partnership activities was developed by the drafting team, gathering the views of all the different sectors to be represented. On November 5th, the call for membership to join this new association was released to the CCAM stakeholders, with distribution of the statutes and explanatory information.

29 Draft proposal for a European Partnership under Horizon Europe Connected, Cooperative and Automated Mobility (CCAM) Version 13 May 2020, https://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/ec_rtd_he-partnerships-connected-and-automated-driving-ccam.pdf

14. On November 23rd, an Information Day on CCAM was organised, to present to the public the objectives of the Partnership, collect opinions about the SRIA, and inform about the new association. More than 150 participants joined this Information Day. The draft SRIA and the call to join the new association were distributed again at this occasion. The event was registered and posted online, so the information stays available publicly.

The CCAM SRIA evolved through these stages and it received plenty of input and feasibility checks from key stakeholders (all of these are included in Table 2: Stakeholders involved in the CCAM SRIA development) in a wide variety of technology areas.

Table 2: Stakeholders involved in the CCAM SRIA development

CCAM stakeholders contributing to the Partnership SRIA development	
Research providers	AVL, AIT, Bast, CDV, CNRS, CEA, CEIT, Cerema, CERTH/HIT, Cidaut, CTAG, DLR, Eurecat, Everis, FEV, fka, FMI, Fraunhofer, I2CAT, ICCS, ICOOR, IDIADA, IFPEN, IMEC, INDRA, JRC, KTI, Lero, LINKS Foundation, Nervtech, Ricardo, RINA, RISE, SAFER, SINTEF, Tecnalia, TNO, TOI, Vicomtech, VTI, VTT
Universities	Aachen, Bari, Bordeaux, Budapest, Chalmers, Cork, Delft, Deusto, DTU, Dublin, Eiffel, Eindhoven, Florence, Galway, Gothenburg, Istanbul, Leeds, Leuven, Ljubljana, Madrid, Maynooth, Metropolia, Milano, Modena, Mondragon, Newcastle, Paris, Poznan, Prague, Sligo, Surrey, Thessaloniki, Turino, Upper Austria, Belfort-Montbéliard, Valencia, Warsaw, Zilina
Automotive	Akka, Alstom, Altran, BMW Group, Bosch, Bridgestone, CAFA Tech, Continental, DAF Trucks, Elaphe, Eminko, Eurocybcar, Farplas, Faurecia, FCA, Ford, GM, Hidria, Irizar, JLR, LAB France, Michelin, Mobivia, Navya, Pirelli, Reflective, Renault, Tofas, Valeo, Volkswagen, Volvo Group, Yamaha
ITS	Bestmile, Dynniq, HERE, Kapsch, LIT Transit, MAP TM, Mobilits, NNG, OmniOpti, PTV Group, Swarco, TomTom, TTS Italia, Trust-IT Services, Ubiwhere, YoGoKo
Telecom/IT	ELMOS, Ericsson, EVERIS, Huawei, Intel, NXP
Infrastructure	Abertis, Asfinag, Sanef, Vinci
Freight & logistics services and users	ALICE, Colruyt Group, Gebruder Weiss, Einride, IDIT, Procter & Gamble
Countries	Austria, Belgium, Czech Republic, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Spain, Sweden, UK
Regions, cities and public transport operators	Brussels, Catalunya, Flanders, Gothenburg, Helmond, Paris/Ile-de-France, Madrid, Rotterdam, Stuttgart, Usti, Tampere, Vienna, Wallonia
Representative bodies:	ACEA, ACEM, ALICE, AMICE, ANEC, C2C-CC, CEDR, CLEPA, CONEBI, EAPA, EARPA, ECTRI, EFA, EPoSS, ERF, ERTICO, ETNO, ETRMA, EUCAR, Eurocities, EuroRap, FEHRL, FEMA, FIA, FIGIEFA, GSMA, IRU, POLIS, UITP, 5GAA
Technology clusters and test centres, etc.	AV Living Lab, AIPSS, Aurora Snowbox, Austriatech, CARA, Catapult, Drive Sweden, FMCI, Lindholmen, Moveo, Pole MEDEE, PTCarrereta, ACS Slovenia, Business Tampere, Vedecom, VDI-VDE-IT, Zalazone, Zenzic

5. Policy context

5.1 Policy aspects

European Partnerships are key implementation tools addressing global challenges and contributing significantly to achieving the EU's political priorities. The transformational change in mobility will have a huge impact on all road, traffic and driving situations. In addition, advancing digitalisation, extreme growth in (big) data availability and increasing connectivity for users are shaping new business models in transport, modifying the future mobility needs and perceptions in society. With the expected impacts, the CCAM Partnership will contribute to the UN Sustainable Development Goals[30] (SDG), specifically to

- **SDG 3** (Ensure healthy lives and promote well-being for all at all ages)

  e.g. by providing safer, more sustainable and efficient mobility thus contributing to reducing the number of deaths from road traffic accidents and reducing automotive emissions for improved air quality and health;

- **SDG 9** (Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation)

  e.g. by funding research and innovation following a strategic agenda for significant economic impact, providing opportunities for new products and services in an area of utmost importance to the future competitiveness of the European transport industry;

- **SDG 11** (Make cities and human settlements inclusive, safe, resilient and sustainable)

  e.g. by providing safe, affordable, accessible and sustainable transport systems for all people including persons in vulnerable situations, and by drastically reducing the number of accidents caused by human error and thus increasing safety for all road users, including unprotected ones;

- **SDG 13** (Take urgent action to combat climate change and its impacts)

  e.g. by optimising infrastructure capacity usage, reducing congestion, smoothening traffic flow, avoiding unnecessary trips and thus reducing CO_2 emissions.

In relation to SDG 11, the CCAM Partnership is contributing to the EU Mission on Climate-Neutral and Smart Cities[31]. The aims of this Mission are to deliver 100 climate-neutral and smart cities by 2030 and to ensure that these cities act as experimentation and innovation hubs to enable all European cities to follow suit by 2050. This Mission is central to the overall European Green Deal[32], a comprehensive and ambitious strategy package for Europe to become the world's first climate- neutral continent by 2050. An example of the Partnership's contribution to the Cities Mission is the 2023 call on co-designed smart systems and services for user-centred shared zero-emission mobility of people and freight in urban areas. The Partnership will maintain this involvement.

30 Take Action for the Sustainable Development Goals, https://www.un.org/sustainabledevelopment/sustainable-development-goals/

31 European Missions. 100 Climate-Neutral and Smart Cities by 2030. Implementation Plan: https://research-and-innovation.ec.europa.eu/document/download/d2eb2069-3b4a-4015-9801-7daab749d31b_en?filename=cities_mission_implementation_plan.pdf.

32 The European Green Deal, COM(2019) 640 final, Brussels, 11.12.2019, https://ec.europa.eu/info/sites/info/files/european-green-deal-communication_en.pdf

The CCAM partnership will contribute to achieving the General Objectives and trigger the expected positive impacts for society (safety, environment, inclusiveness), economy (European competitiveness) and science. The intervention logic describes how the different levels of objectives will at the same time target the Problem Drivers and realise the expected impact (see figure below).

Figure 7: Intervention logic of the CCAM Partnership based on Problem Drivers, Operational Objectives. and Specific Objectives.

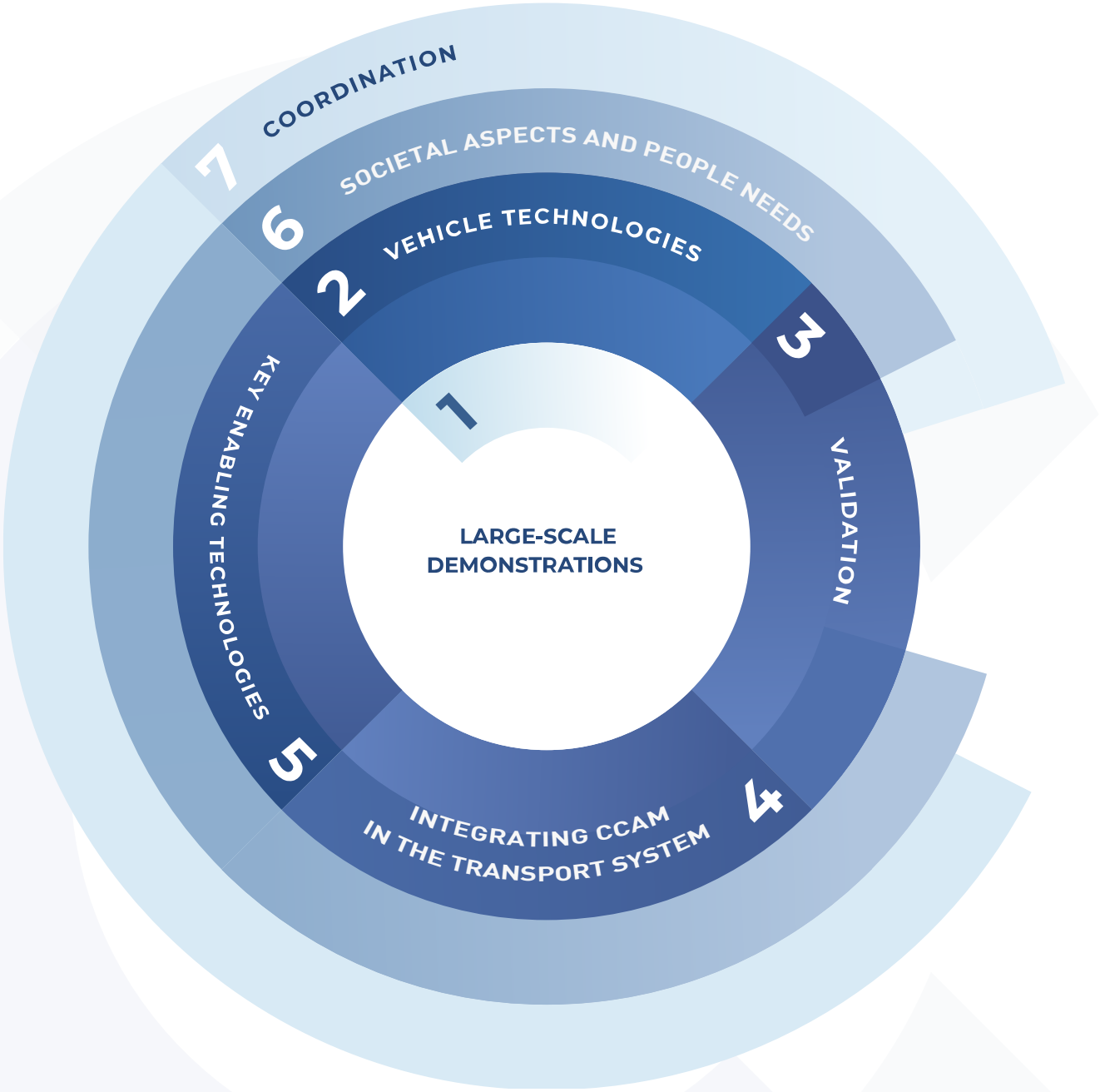


Figure 10: The seven CCAM clusters

The CCAM Cluster structure (see Figure 10) shows the links between specific R&I actions and the progress towards the Operational Objectives (Chapter 5, see Figure 11: Clusters contributing to achieving the Operational Objectives (OO) of CCAM.) of the Partnership. The Clusters are interlinked and each Cluster provides input to other Clusters. Together they form a comprehensive framework for achieving the Partnerships' Specific and General Objectives and delivering the expected impacts.

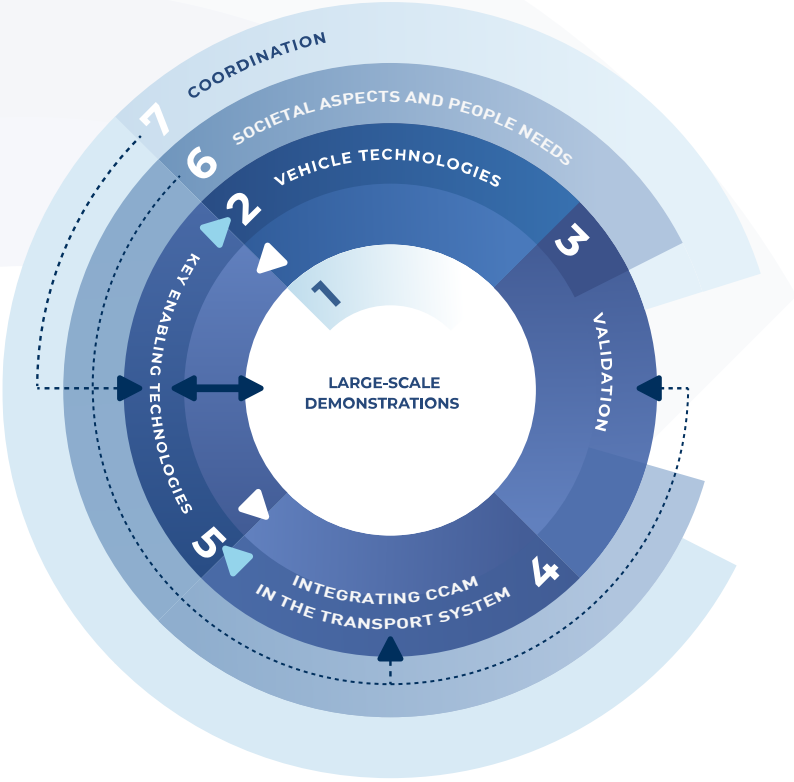
The starting point is the understanding of the people needs and societal aspects of mobility (see description Cluster 6), advancing technologies (see Cluster 2, Cluster 4 and Cluster 5) and demonstrating the maturity at a large scale (see Cluster 1 and Cluster 3).

Key enabling technologies (see Cluster 5) are needed to enhance solutions. These will be implemented together with future vehicle technologies for sensing, sensor fusion and enhanced safety systems (see Cluster 2). The overall transport system integration complements safe human- machine interaction to understand the requirements and needs for traffic and fleet management and provide physical and digital infrastructure support (see Cluster 4).

9.5. Cluster 5: Key Enabling Technologies

Introduction

This Cluster focuses on CCAM R&I actions on enabling technologies, driven by digitalisation and extending the application of these technologies beyond the individual vehicle in a system's approach. In case of e.g. AI, it has the capacity to go way beyond on board decision making, based data from in-vehicle sensors. Data from other vehicles, infrastructure and back offices can be used in



decision making in complex scenarios including safety critical situations, ranging up to traffic management, emission management, charging of vehicles and provision of many new and emerging mobility services.

Thus, the Cluster fosters cooperation amongst stakeholders from several technology areas and industries. Safe and secure operation of vehicles and mobility systems is key to develop trust and establish user adoption of CCAM solutions.

This Cluster 5 will

- Provide AI and cybersecurity solutions to be integrated in vehicle technologies (related to environment perception and on-board decision making) (to Cluster 2).
- Develop harmonised procedures, methods and tools for the validation of cyber security for inclusion in conceptual description of an approval scheme of CCAM systems (to Cluster 3).
- Provide the basis for validation methods and tools for AI applications in CCAM for integration in validation procedures for CCAM systems (to Cluster 3).
- Develop and/or integrate Key enabling technologies (e.g. secure communication, robust and resilient connectivity, edge computing) contributing to better performance of vehicle-transport system integration (to Cluster 4) and of in-vehicle technologies integration in the cloud-edge continuum.
- Elevate the possibilities for synergies with stakeholders, also beyond originally mobility focused partners, using enabling technologies to take a systems' perspective in road mobility and CCAM Technologies.

A harmonised approach to further develop these technologies can help to reduce market fragmentation, currently hindering EU companies to fully benefit and exploit new mobility business cases based on CCAM. For this, the extended domains are addressed with R&I actions for cybersecurity, information

systems' optimisation, striving for climate friendly applications.

- Accelerated AI development and training for CCAM enabled by a relevant set of real and synthetictraffic events and scenarios.
- AI based CCAM solutions will evolve from reactive and/or adaptive system support into predictivesystem state awareness (including driver state and user diversity), decision-making and actuation,enhancing road safety especially in near-critical situations.

Timeline

The Cluster 5 actions all follow a logic of a step-wise approach: moving from development on a component level (mostly in RIAs) to integration into system approaches and adjusting to needs of specific Use Cases or user groups (in IAs) ultimately to application and implementation.

The first two R&I actions within Cluster 5 are planned to have an early start, with the earliest planned implementation. The third and fourth R&I actions are planned to start in the second and third year, as these actions will advance based on inputs and needs from Cluster 2, 3 and 4, with a close link to Cluster 6 for especially the R&I action on Explainable AI. The last R&I action will have its start pending on results of projects within Cluster 7 on test data sharing.

Innovation Actions will follow and advance technical maturity and progress the state of the art after the first phase, delivering mature results ready for testing/implementation. The following image aims at making this progression process transparent. As the Actions in Cluster 5 concern fairly new technologies in the application domain, the sequence of RIAs, IAs and implementation is expected to run throughout the running time of the Partnership. Based on inputs and needs from Clusters 1, 2, 3, 4 and 6, detailed (R)IA needs and implementation paths can be defined. In the same way, new key enabling technologies can arise from other sectors, for inclusion and implementation here.

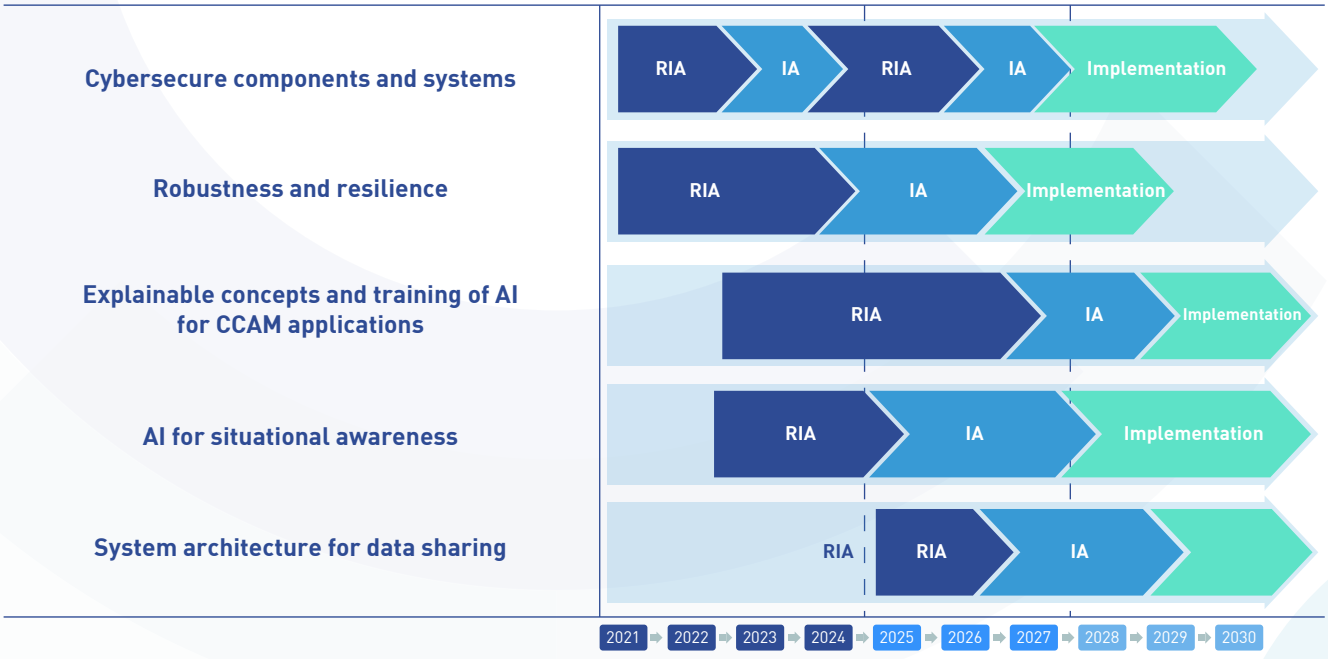


Figure 16: Cluster 5 R&I Actions over the Partnership Programme timeline.

10. SRIA Implementation

The Partnership will be implemented through collaborative R&I projects funded by the Horizon Europe programme and by additional activities provided in kind by the partners. A number of activities, such as coordination and dissemination efforts, support to harmonisation and standardisation, international cooperation, etc. will be covered both by EU funding in the different types of EU projects and complemented by in-kind additional activities.

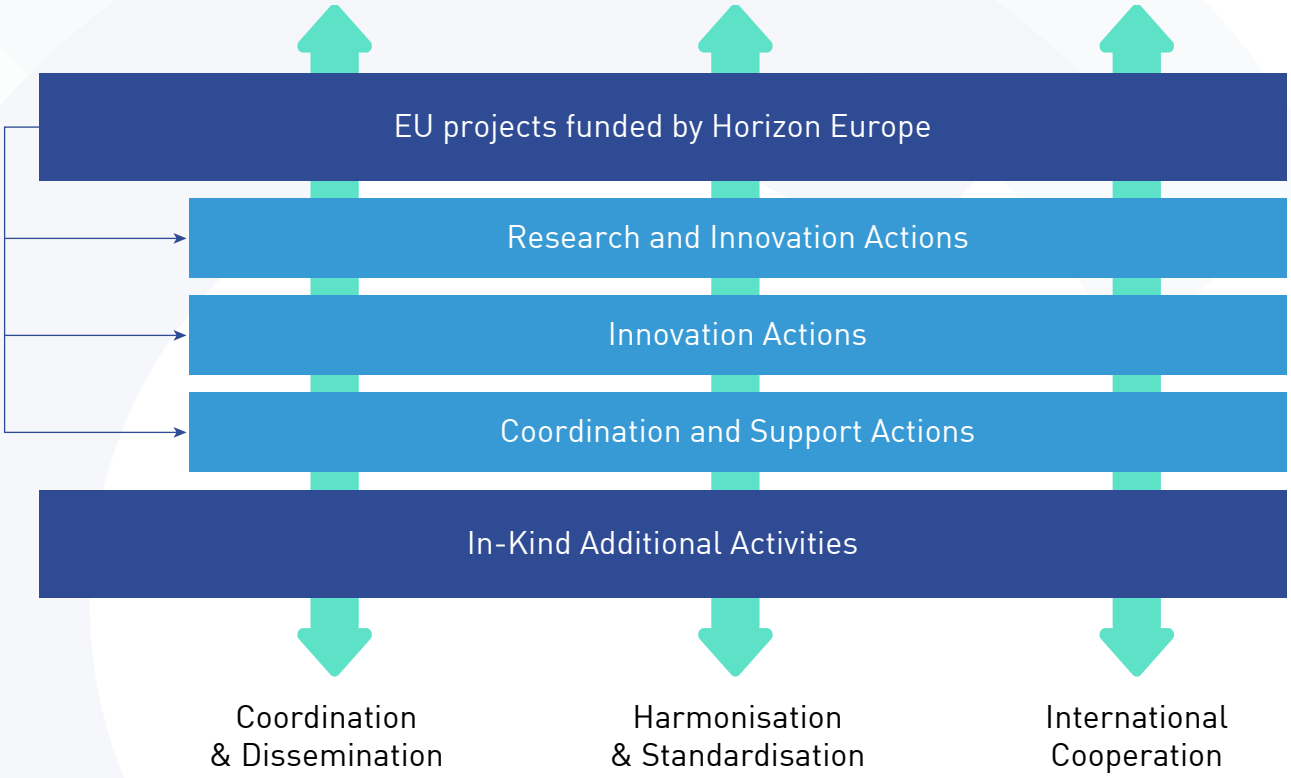


Figure 19: SRIA Implementation activities

10.1. CCAM calls for projects under Horizon Europe

The SRIA describes the R&I Actions necessary to advance toward the Deployment Readiness of CCAM. An increasing maturity of technologies (TRL) and successful delivery of enabling activities will be needed. The implementation of the SRIA will mostly be done through the different types of European collaborative projects that are described in the following sections. The members of the CCAM Partnership have expressed their willingness to contribute to these activities.

Research and Innovation Actions

Research and Innovation Actions (aiming at TRL: 3-5 [136].) are the basis for all developments towards cooperative, connected and automated mobility. The Research and Innovation actions developed in the seven CCAM Clusters will be aiming at delivering new knowledge, and/or be exploring the feasibility of improved or new technologies. Instruments of Research and Innovation Actions can include e.g. desk research, feasibility studies, technology development, HMI studies including user tests, laboratory testing, model development, cost-benefit analysis, risk assessment and simulations. Some examples of topics for RIAs expected:

136 Section G on TRL definitions: https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018-2020/annexes/h2020-wp1820-annex-ga_en.pdf

Technology Readiness Levels

Technology Readiness Level	Description
TRL 1.	basic principles observed
TRL 2.	technology concept formulated
TRL 3.	experimental proof of concept
TRL 4.	technology validated in lab
TRL 5.	technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL 6.	technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
TRL 7.	system prototype demonstration in operational environment
TRL 8.	system complete and qualified
TRL 9.	actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

- The development of reliable occupant protection technologies and HMI solutions to ensure the safety of highly automated vehicles. This will require a mix of research activities including
- modelling and simulation in addition to testing solutions in the laboratory in order to provide significant advances with respect to the state-of-the-art.
- The development of explainable and trustworthy Artificial Intelligence (AI) concepts, techniques and models for CCAM, including the development of decision making (i.e. planning and acting) based on robust and reliable detection and perception, as well as unbiased AI training approaches.
- The development of technologies for cyber secure and resilient CCAM for safe and secure operation. This will require development and validation of methods and tools, as well as specific security building blocks, with a systems approach and harmonised interfaces and protocols to enable integration of vehicles, infrastructure, back-offices and mobility service centres
- The development of methodology and indicators to assess the impacts of CCAM solutions on mobility and wider socio-economic effects. This requires a multidisciplinary approach encompassing aspects such as public health, land use/infrastructure need, environmental aspects such as energy use, accessibility, air quality, carbon emissions and impact on economy, employment, working conditions and required skills etc.

Innovation Actions

On the basis of the results of amongst others the Research and Innovation Actions, further development shall be carried out in the Innovation Actions (aiming at TRL: 6-8). The Innovation Actions will be developing e.g. designs for new, altered or improved products and/or services. Activities may include prototyping, testing, demonstrating, piloting, large-scale technology and application validation including validation of the economic viability. Two examples of topics for RIAs expected:

- The development of more powerful and reliable on-board perception and decision-making technologies – activities need to include also the testing of prototype solutions on vehicles in realistic conditions in order to ensure that complex environmental conditions can be tackled accordingly.
- The central element of the CCAM Partnership is the large-scale demonstration activities (see Chapter 7) in Cluster 1. While demonstrations with Pilots and FOTs focus on the technical usability, living labs will be a key instrument to evaluate the usability of CCAM within society by including citizens in testing and demonstration.

Coordination and Support Actions

Coordination and Support Actions will be required beyond Research and Innovation Actions or innovation Actions to pave the way towards deployment in cases where building of consensus is required among stakeholders for harmonised approaches and to ensure that common methodologies are promoted and regularly updated to reflect lessons learned and best practices. Coordination and Support Actions have been defined in the Horizon 2020 Framework programme[137] as "Actions consisting primarily of accompanying measures such as standardisation, dissemination, awareness- raising and communication, networking, coordination or support services, policy dialogues and mutual learning exercises and studies, including design studies for new infrastructure and may also include complementary activities of strategic planning, networking and coordination between programmes in different countries".

137 HORIZON2020–WORKPROGRAMME2018-2020GeneralAnnexes,https://ec.europa.eu/research/participants/data/ref/h2020/other/wp/2018- 2020/annexes/h2020-wp1820-annex-d-csa_en.pdf

all members invited to participate in this process. Member States organisations will be involved in this process directly through their membership in the association. Recommendations will also be presented in the States Representatives Group. These R&I priorities for the next Work Programmes will be developed together with the European Commission services within the Partnership Board: the delegates of the association will present to the Partnership Board the input prepared within the association, to discuss with the EC services with the goal of reaching a common understanding. The text of the R&I topics will be finalised and processed by the European Commission into the Horizon Europe Work Programmes.

On an annual or bi-annual basis, according to the reporting methodology described in the Memorandum of Understanding:

- **a)** Assess the progress done towards the Partnership objectives, using the Key Performance Indicators (KPIs) described in chapter 6.
- **b)** Report on the functioning of the Partnership, including on openness, transparency, collaboration and synergies with other European Partnerships and initiatives.
- **c)** Plan and report the additional activities done beyond EU projects (as described in chapter 8.2 and in the MoU): develop every year a plan of which upcoming additional activities can support the objectives of the Partnership, and then report annually which of these additional activities have been done, including qualitative assessment and quantitative data whenever possible.
- **d)** Provide information on investments in operational activities (as described in the MoU): investments spent beyond the work foreseen in the SRIA, including public and private investments mobilised to exploit or scale-up CCAM. This is used to calculate the leverage effect of the Partnership.
- **e)** Develop "impact case studies": success stories that can be used to highlight prominent results or lessons learned from specific projects/activities, or highlight follow-up using other instruments.

The planning and reporting of additional activities and investments in operational activities will respect confidentiality and competition requirements.

11.3. Process and timing for updating the SRIA

The SRIA provides the strategic framework for preparing future activities within the Partnership. In order to consider recent developments and rapid technological progress (i.e. of disruptive nature), the SRIA will be updated during the lifetime of the Partnership to reflect any major technological advancement, new emerging challenges, or evolving societal needs. So, even though the SRIA at hand is covering the full duration of the Partnership, an evaluation during the Partnership lifetime will be necessary.

This review and updating process will be done in full openness, involving all the members of the Partnership, again in a co-creation approach. The coordination activities from Cluster 7 will provide the knowledge on latest project results and achievements, and all Clusters will support the evaluation by providing relevant expertise on the different R&I fields. The European Commission services will participate to the evaluation. Member States Representatives will be involved through the States Representatives Group. All members of the Partnership will be consulted in the drafting of the updated SRIA version, and a public consultation will be organised, to allow also non-members to provide their views. The updated SRIA will be presented to the General Assembly of the Partnership association for endorsement by the stakeholders, and to the Partnership Board for agreement with the European Commission.

Co-funded by
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EUROPEAN PARTNERSHIP

CCAM

CONNECTED, COOPERATIVE
& AUTOMATED MOBILITY

V2.4 | 18/01/2024

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