Cluster 4 Digital, Industry and Space – Orientations for Work Programme 2026-27

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This Orientations document outlines the expected outcomes envisaged for topics in the part of the Work Programme 2026-27 on Cluster 4 – Digital, Industry and Space.

The WP 2026-27 will address the three core areas of the Competitiveness Compass presented by the Commission on 29 January: (i) closing the innovation gap through innovative technologies geared towards deployment; (ii) supporting decarbonisation and competitiveness through focused industrial technologies; and (iii) reducing excessive dependencies and increasing security.

In addition to this Work Programme part, Cluster 4 will participate in a joint Clean Industrial Deal Call, which will be discussed and developed with the Programme Committee in the relevant cluster-specific configurations.[1] The aim will be to increase the competitiveness and decarbonisation of industry. The initiative will allow Horizon Europe beneficiaries to feed the EU deployment pipeline with R&I solutions close to market uptake and deployment, whilst also supporting the development by 2035 of a new batch of industry-led demonstrators designed for higher market readiness.

The expected outcomes and R&I priorities are outlined under the destinations corresponding to the six expected impacts for Cluster 4 in the Strategic Plan 2025-27. The first two impacts have been merged into a single destination entitled: “Leadership in materials and production for Europe”, reflecting the close synergies between the green and digital transition and industrial resilience.

[1] The final approval should take place in the context of the Work Programme “Missions and other crosscutting activities” under the Strategic Configuration of the Programme Committee.

DESTINATION Leadership in materials and production for Europe

This part of the orientations will support the two industry-related expected impacts of Cluster 4 set out in the Strategic Plan 2025-27, now merged into a single destination.

Addressing main policy priorities:

The Competitiveness Compass announces initiatives that should be served directly by industry-linked activities in Cluster 4, through new, focused R&I activities, but also through the activities supported up to now:

- Clean Industrial Deal (see the proposed Clean Industrial Call presented in a separate paper);
- Critical Raw Materials Act, Net-Zero Industry Act, Future Industrial Decarbonisation Accelerator Act;
- Advanced Materials Communication and future Advanced Materials Act;
- Future Circular Economy Act;
- Steel and Metals Action Plan;
- Chemical industry package;
- Future European Strategy for Housing Construction;
- Strategy on research and technology infrastructures; and
- Contribution to Action Plan on automotive industries .

In order to better translate these policy priorities into actions, to integrate the latest inputs from the partnerships, and to achieve synergies, the orientations for the industry side of Cluster 4 have been set out under new headings under the WP 26/27, which reflect better key strategic priorities. The headings used under the two industry-focused destinations in previous WPs, reflecting different partnerships and industrial sectors, are replaced by new headings making strongly interconnected contributions to the corresponding expected impacts in the Strategic Plan 2025-27 (which is the guiding strategy), on green and digital transition and on autonomy in raw and advanced materials. There will be an additional focus on suppliers of the automotive industry, often SMEs, and research into innovative manufacturing equipment they should develop for the production of electric cars.

The new approach takes into account R&I investments under previous work programmes and intends to introduce more synergies with other pillars (notably the EIC WP) and clusters (notably clusters 5 and cluster 6) in Horizon Europe and with other EU programmes. Topics in the WP 2026-27 will increasingly combine the priorities of different partnerships to enable synergies, e.g. with the Investment fund, while considering particularities of each partnership.

It is important to note that the expected outcomes under the headings below do not correspond to specific topics but should instead be achieved by a project portfolio resulting from the actions under each outcome. Topics should be larger in terms of budget and number of projects.

A. Sustainable advanced materials, raw materials and chemicals strengthening Europe's autonomy

Expected Outcomes:

- Reducing dependencies of critical raw materials and chemicals of concern

R&I, guided by the SSbD framework, on innovative advanced materials (IAM4EU) and chemicals proposing a lean use of critical raw materials and alternatives to substances of concern (linked to Commission's work on substitution). Substances addressed should support strategic policy interests. The R&I should span the whole life cycle from design, development to uptake including production and manufacturing processes.

R&I for exploration, extraction, processing and recycling for primary and secondary critical and strategic raw materials. Contribution to benchmarks set out in the Critical Raw Materials Act for EU capacity of 10% domestic extraction; 40% of domestic processing; 25% of domestic recycling; and diversifying sourcing from a single third country to 65% of annual EU consumption by 2030 (including Strategic Partnerships with third countries).

The critical raw materials partnership (covered in the WP 2025) will continue to cover safe and sustainable mining and processing for CRMs.

- Disrupting the innovation process for chemicals and advanced materials in Europe

Creation of advanced digital tools and sources of FAIR data needed to accelerate the design, development and manufacturing of sustainable chemicals, alternatives to substances of concern and cutting-edge advanced materials with novel functionalities. This will include tools for predictive performance and lifecycle analysis. It will lead to increasing the knowledge capacity available to European industry as well as for regulators to accelerate market access. Targets are the increased use of artificial intelligence and the support to self-driving labs for chemicals and advanced materials, including the establishment of a network. They will support the SSbD framework, and collaboration and networking between academia and industry. Links should be developed with sector specific solutions such as for automotive under cluster 5, magnets and materials for energy and CO2 conversions.

Cooperation with the activities funded under the Chips Joint Undertaking and photonics partnership will be encouraged as well as other related application initiatives e.g. in Energy.

- A step change in the risk assessment of chemicals and advanced materials in Europe

Innovative methods to speed up risk assessment and market access of SSbD chemicals and advanced materials, including standards, norms and risk assessment methodologies Commission's roadmap on moving away from animal testing.

Strategic partnership with third countries, including enhanced dialogue with Japan, on Advanced Materials.

B. Fostering leadership in Innovative Advanced Materials and technologies

Expected Outcomes:

Develop new methods and processes for the production of promising innovative advanced materials (including 2D Materials) and associated technologies supporting the green and digital twin transition. Emerging IAM and IAM-based technologies will notably deliver solutions contributing to the leadership and sovereignty in electronics, photonics, quantum and other key technologies. They will also address the growing demand for sustainable energy solutions (e.g. emerging batteries and clean hydrogen technologies). Moreover, compliance with a safe and sustainable by design framework will

boost the confidence of industry and end-users and enhance the Innovative Advanced Materials ecosystem and uptake.

Cooperation with the activities funded under the Chips Joint Undertaking and photonics partnership will be encouraged as well as other related application initiatives e.g. in Energy.

1. **Establish robust EU IAM/IAM-based technologies supply chains** benefitting strategic fields such as ICT (electronics, photonics, quantum technologies…), energy (e.g. with advanced portable and stationary batteries and supercapacitors, and solutions for hydrogen generation and storage), health, defence, that will contribute to European technological sovereignty by reducing dependence on third countries.
2. **Keep the EU position as the science leader** in the field and **discover new applications for IAM/IAM-based technologies,** and advance the most promising ones towards experimental and, in due course, industrial production.

C. Fast-tracking circularity in value chains

Expected Outcomes:

- Production becomes fully circular (from cradle to cradle)

The R&I will support all steps in enabling circular value chains.

This will include the development of safe and sustainable new advanced materials for circularity, in particular recyclable polymers and composites and magnets.

The manufacturing industry will support circular products, including an increased use of secondary materials, and the de-manufacturing and re-manufacturing of e.g. components. This should enable the emergence of transformation pathways and circular manufacturing eco-systems. New innovative manufacturing equipment is necessary for the production of circular components and products, including batteries for e.g. electric vehicles.

The processability and the resulting product quality when using recycled or alternative bio-based textile fibres will be addressed.

For the automotive sector, projects would collaborate with the 2Zero Partnership in Cluster 5.

- Resource efficiency is increased significantly (focus on materials, water and energy)

The R&I will optimise efficiency in terms of materials, water and energy along the value chain, making production and manufacturing more competitive, safer and more sustainable.

Process optimisation will be supported in both energy-intensive and manufacturing industries.

In the energy-intensive industries, an additional priority will be the conversion of hard-to-recycle, mixed and impure waste streams to energy carriers or to critical and strategic raw materials, in order to reduce import dependencies.

The reduction of virgin water consumption will also be an objective for the energy-intensive industries and textiles.

In both manufacturing industry and construction, an additional priority will be the reduction of errors and waste, and hence the need for re-working. Additionally, R&I for the manufacturing, assembly and disassembly of prefabricated components for construction will be supported.

- Circularity across value chains and industries made a reality through FAIR data and tools

The R&I will enable the sharing of FAIR and interoperable data and tools across value chains, to foster circularity, including data needed for materials and component development, circular product design and the use of more circular resources. Specific applications to automotive production will be covered in the portfolio.

A particular aim will be to close data gaps for circular lifecycle analysis for advanced materials, including tools for predicting performance and lifecycle of materials and modelling along value chains and the creation of new business models (IAM4EU, with link to Materials Commons for digital tools and data).

For the process and manufacturing industries, there will be emphasis on the digitalisation of circular value networks, with smart, data-driven intralogistics; and unlocking the power of data and AI for circularity (with ADRA), including product traceability.

D. Disruptive technologies to increase the usage of green energy

Expected Outcomes:

- Green energy given a boost through storage, carriers and management

R&I on resilient storage and management of green energy adapted to the need of the process industry including R&I on new advanced materials for membranes and carriers and storage (e.g. for batteries and hydrogen). These will be R&I actions for TRLs 4-6.

E. Decarbonisation of Energy-Intensive Industry

The priority will constitute the R&I flagship initiative of the Clean Industrial Deal (CID) (see the CID Call presented in a separate paper).

In order to increase the European competitiveness and decarbonisation of these sectors, this flagship initiative will provide support to Horizon Europe beneficiaries to feed the EU deployment pipeline with R&I solutions close to market uptake and deployment, whilst also supporting the development by 2035 of a new batch of R&I demonstrators designed for higher market readiness, involving industry-led projects, with innovation actions for TRLs 7-8.

It will include a coordinated effort supported by Horizon Europe and Innovation Fund activities to design adequate interfaces, keeping in mind simplification and customer orientation. The initiative will support the development of green lead markets and the standardisation of green products in an international context.

F. Technology infrastructure, knowledge valorisation and support for scaleups and startups

Expected Outcomes:

These elements will be pursued through a strictly limited number of coordination and support actions, and other actions, but will also be integrated in the wider R&I priorities under the headings above, including the use of financial support to third parties (FSTP).

- Synergies with EIC, including Accelerator Challenges for Advanced Materials and Manufacturing, and Fast Track to Innovation actions
- Access to services of Technology Infrastructures, through dedicated activities and integration;
- Valorisation of knowledge for the adoption of green and digital technologies by SMEs (including stronger interactions between universities, businesses and public sector on real world challenges; standardisation; and interactions with SSH researchers);
- A new administrative agreement with the JRC on the EU Industrial R&D Investment Scoreboard;
- Support to the EU initiatives on Technology Infrastructures, including a second wave of pilot actions.

DESTINATION Developing an agile and secure single market and infrastructure for data-services and trustworthy artificial intelligence services

Addressing main policy priorities:

The Political Guidelines put a strong emphasis on frontier technologies as new avenues of growth for the EU. Virtual Worlds represent such frontier technologies, combining AI, data, extended reality, connectivity, IoT that will bring massive opportunities across sectors and applications, from manufacturing to health to cultural and creative industries. The global market size is expected to grow from EUR 27bn in 2022 to EUR 800bn by 2030. The overarching aim of the EU strategy on Web 4.0 and virtual worlds is to guide the next technological transition that will heavily rely on the development of these frontier technologies and ensure novel, immersive and innovative digital environments are open, secure and trustworthy for all EU citizens, businesses, and public administrations. To this aim, the European Partnership on Virtual Worlds will foster excellence in research and develop an industrial and technological roadmap for virtual worlds, thereby supporting a cohesive European Virtual Worlds and Web 4.0 industrial ecosystem, strengthening European competitiveness.

A well-functioning European ecosystem of digital commons, based on open technologies and driven by European values, and a thriving culture of collaboration and social innovation are essential for ensuring sovereignty, trust and user empowerment.

Covered in this destination:

A. Telco-Edge-Cloud/ 3Cs / Open Internet Stack

B. Sustainable end-to-end AI compute continuum

C. Data (under AI, Data and Robotics partnership)

Expected outcomes:

A. Telco-Edge-Cloud continuum/ 3C Network (Connected Collaborative Computing) and Open Internet Stack

1. Demand-side 3C pilots and advanced research on converged Telco Edge Cloud Infrastructure:

The outcome covers demand pilots using end-to-end computing, communication, and storage horizontal facilities, building on the developments of the supply-side large-scale pilot project called in Horizon Europe WP25. Pilots will focus on alignment of stakeholders and build on achievements by the dedicated CSA in WP25.

Demand pilots will integrate future domain-specific applications and services with an emerging European 3Cs infrastructure, which exposing different network features which will also be the subject of further long-term research. Key features of 3C networks will include integrity, security and

privacy offering resilience to emerging quantum threats, mobility, and service continuity across inter-domain and multi-cloud deployments and ecosystems.

These demand pilots will focus on 3Cs demand in vertically-oriented industrial applications such as "industrial virtual worlds". Demonstrations will include networked, agile and green IoT-edge computing solutions for an extended decentralisation of industrial virtual word concepts, or cloud-edge platforms architecture and solutions in different areas or industrial sectors.

Pilots will exploit robust, operational AI models combined with open application interfaces and standards to allow the growth of European ecosystems with a focus on SMEs, innovators and start-ups and, where applicable, open-source communities.

In addition to pilots, the possibility to also cover advanced research on converged Telco Edge Cloud Infrastructure addressing long-term research on enablers for Telco Cloud will be explored. Such research would include the environment to host network functions and edge services, and to allow future networks to be built over heterogeneous resources across the edge to cloud computing continuum. The proposed solutions would aim at optimizing crucial elements such as bandwidth, spectrum and computing while ensuring high-quality service delivery.

2. Open Internet Stack

To support the 3Cs process and to ensure the continuum-effect of the initiative, this will seek to provide EU citizens and businesses with a wide portfolio of Open Source digital components and tools. These will be aligned with European digital rights and principles and reduce Europe's reliance on global platforms that dominate the digital economy through proprietary centralised technologies and extractive business models.

Working towards a transparent and inclusive digital ecosystem, the Open Internet Stack's main outcome will be a catalogue of Open Source alternative solutions made available as easy to deploy, fully aligned with European values such as transparency, cooperation, market contestability as well as compliant-by-design with the EU legal and trust frameworks[2].

The "Open Internet Stack" initiative will mainly revolve along 4 main trajectories:

1. Ensuring that the Open Internet Stack catalogue and components are regularly maintained and updated to reflect evolving technologies and standards.
2. Developing new solutions under the Open Internet Stack to address the needs of both supply and demand side of the rich and diverse eco-system of 3C European providers (internet service providers, telecommunication providers, VPN providers, hosting providers, cloud providers etc.) and verticals.
3. Developing new sector-agnostic Open-Source digital commons supporting the emergence of competitive, sovereign, resilient, and transparent European applications.
4. Open Sourcing the lower layers of the computation stack.
5. Support appropriate recognition schemes for Open Source contributors.

[2] Including Regulation (EU) 910/2014, as amended by Regulation (EU) 2024/1183 of the European Parliament and of the Council of 11 April 2024 as regards establishing the European Digital Identity Framework

B. Sustainable end-to-end AI compute continuum

1. **New approaches for decentralized and federated AI data processing**

These comprise tools and techniques to enable AI data processing to overpass current compute capacity bottlenecks, removing at the same time the tension between functionality and security, and to achieve scale by leveraging distributed and federated AI data processing architectures. This includes the exploitation of alternative hardware processing architectures and scaling approaches, as well as less resource intensive models.

2. **Optimisation of power consumption for data centres, the compute continuum and software engineering:**

Energy efficiency and sustainability of AI data processing in Data centres: Data centres are complex systems with essential components like core computing systems, energy management, cooling, and heat dissipation. To optimize their functioning, data centre management and design solutions, including AI solutions, are needed to minimize their carbon and environmental footprint. Examples include: closed-circuit liquid cooling, energy system planning and operation scheduling of IT workloads, etc.

Compute continuum energy awareness and *optimization*: New tools and mechanisms to address energy optimisation and hardware efficiency are necessary for monitoring and reducing power consumption associated with the execution of AI across the edge to cloud computing continuum. These should cater for the heterogeneity of AI processing architectures and the variety of devices capable acting as Edge nodes. In this respect, research should explore new metrics for the assessment and comparison of energy efficiency for AI compute infrastructures beyond todays' metrics (i.e. PUE, WUE, and DCiE).

Software engineering can play a crucial role in developing sustainable AI-based software systems. This implies: the integration of resource-aware techniques, a general reduction of complexity, allowing for software to be observable, and consider AI pipelines, scaling optimisation methods, and resource efficiency in processing infrastructure

C. DATA (under AI, Data and Robotics partnership)

1. **Develop advanced and agile compliance technologies** to support the implementation of the Data Union Strategy, Common European Data Spaces and the European Business Wallet[3], while also creating innovative, automated/AI-driven technological solutions to reduce administrative burdens for European companies, professionals, and regulatory authorities.

2. **Develop secure and adaptive systems** for managing and enhancing data, including automated curation, labelling, and quality assurance. These systems should streamline the sharing and integration of data from various sources, between sectors and disciplines, ensuring accuracy, availability, interoperability, and provenance. By employing advanced methods for tagging and

[3] One of the flagship initiatives in the Competitiveness Compass

annotating data, they will enhance its relevance and representativeness for specific applications, such as industry, public services, citizen engagement, and AI development. The approach prioritizes delivering high-quality, well-organized data tailored to diverse and evolving needs. It will support the Data Union strategy and the Applied AI strategy and link with Common European Data Spaces and AI Factories.

3. **Support innovation in applied big data analytics frameworks** to process and derive insights from diverse, high-volume, and real-time datasets, focusing on areas such as interoperability, real-time decision-making, and domain-specific applications beyond text analysis.

DESTINATION Achieving open strategic autonomy in digital and emerging enabling technologies

Addressing main policy priorities:

Leadership in key technologies remains a key policy driver for the remainder of Horizon Europe with several of these technologies being critical for Europe's economic security (semiconductors, photonics, quantum, AI for instance).

The expected R&I results of the proposed orientations in this destination will aim at strengthening the related industrial eco-systems in the EU and contribute significantly to their technology sovereignty.

The Competitiveness Compass and the guidelines of the new European Commission underline Artificial Intelligence as a core priority where the EU's approach centers on excellence and trust, aiming to boost research, industrial capacity and innovation while ensuring safety and fundamental rights and turning Europe into the "AI Continent". As part of this AI Continent ambition, the AI factories initiative builds on Europe's existing world-class network of EuroHPC supercomputers to boost Europe's computing power and makes it accessible for start-ups, researchers and industry to train, develop and improve their AI models. An Apply AI Strategy will further complement the actions and foster new industrial uses of AI in sectors, such as manufacturing, automotive, energy, robotics, pharmaceutical and aeronautics, financial services, as well as to accelerate scientific progress, and improve public services, for example in healthcare and justice.

The development of a long-term Quantum Chips plan is another priority identified in the Draghi report and in EVP Virkkunen's mission letter. This notably points to the consolidation of European excellence in all areas of quantum, including via the construction of major quantum infrastructures based on EU technologies. Continued European support for promising quantum computing platforms to form the basis for world-leading quantum computers would be a continuous trend, including via hybridisation with European supercomputers and the consolidation of national and EU efforts to avoid fragmentation.

Covered in this destination:

A. AI Continent – Apply AI and AI in Science Strategies
B. Quantum
C. PHOTONICS (Partnership)
D. Semiconductors
E. Other Emerging Technologies

Expected outcomes:

A. AI Continent – Apply AI and AI in Science Strategies

This heading gathers all the topics focusing on AI, including the topics under the **AI, Data and Robotics partnership**, the **"Resource for AI Science in Europe - RAISE" Pilot**, and the **AI in Science** topics.

1. **[RAISE] Pilot RAISE** (formerly ERC for AI) – **AI Science** and **AI in Science**: The objective of this topic is to pilot a small scale version of the future RAISE initiative, both in terms of governance and content. RAISE will play a crucial role in advancing AI across Europe. It will drive breakthroughs in next-generation AI, addressing key S&T challenges to enable industrial and societal challenges through collaboration and cutting-edge research. RAISE will build on two complementary pillars, one focusing on advancing AI, and the second one advancing the scientific disciplines through the use AI. The Pilot will implement these two pillars in supporting two complementary projects, each of them bringing world-class research teams combining bottom-up research activities and the following top-down driven research topics respectively:
    - **AI Science: Towards the next AI revolution:** Unlocking the full potential of AI models requires effectively activating their capabilities. Advanced techniques for capability elicitation such as post-training, prompt engineering, and scaffolding can enhance their performance, ensuring optimal results.
    - **AI in Science: Development and fine-tuning of AI models and agents** to solve problems in different scientific disciplines. Provide support services for the Horizon Europe projects developing foundation models or applying AI to difficult scientific tasks to accelerate science. Foster international cooperation for enhancing uptake of AI in Science
2. **[AI in Science] Scientific community mobilised to develop and enhance uptake of AI**

   Mobilise different organisations in the scientific community to develop challenges. Enhance uptake of AI in different scientific fields and stimulate the identification and roll-out of scientific challenges that are ripe to be solved with AI. Award prizes for breakthrough research with AI in different domains.
3. **[AI in Science] Scientific community helps accelerate innovation**

   R&I linked to "materials commons" topic on the development on automated design and development processes and reflection on scale-up to production. One use case could be accelerating breakthrough innovations for battery applications (e.g. automotive). Integrate AI with multi-scale and physics modelling. Input from virtual world to output in physical world.
4. **[ADRA] Generative AI Agents for Real-World Applications:** GenAI powered agents, as powerful assistants for complex environments– from advanced analysis to complex action, including AI agents capable of operating in real-world conditions, adapting and responding to dynamic environments.
5. **[ADRA] Autonomous AI Research and Development:** Exploring the potential of autonomous AI systems to assist AI researchers and engineers by automating tasks, providing insights, and enhancing decision-making processes in advancing AI research and technology. Such AI systems could significantly accelerate AI progress.
6. **[ADRA] Energy-Efficient and Sustainable AI Systems:** Development of frugal, energy-aware AI systems optimized for sustainability. These systems will require fewer resources for training and operation, including use cases at the edge for real-time, low-energy applications.
7. **[ADRA] Intelligent and Adaptive Robotics Solutions – co-evolving agile robotics platforms and leading-edge AI solutions:** Development of next-generation AI powered robotics to tackle

sector-specific challenges in agrifood, health, and mobility. These models will enhance efficiency, precision, and adaptability, drive sustainability, foster innovation, and improve competitiveness through optimized processes and tailored solutions. Adaptive robotics systems will be deployable under dynamic conditions, ensuring robustness and maintaining verifiable performance standards in real-world industrial applications.

8. **[ADRA] Next-Generation Agile and Intelligent Robotics Platforms for Industrial and Service Applications:** Development of agile, cost-effective, and intelligent robotics platforms (hardware) with enhanced mobility, autonomy, and adaptability for industrial and service applications. These platforms should leverage advanced actuators, composite materials, and simplified control architectures to reduce cost, weight, and energy consumption while ensuring fluid motion and stability. They should enable robust autonomous navigation, efficient task execution in unstructured environments, improved human-robot interaction, and simplified deployment and maintenance.
9. **[ADRA/Manufacturing] Next-Generation AI for Manufacturing Line Design and Optimization** (joint outcome with Made in Europe Partnership) The integration of next-generation AI, including generative AI, will enable the design, re-design, and continuous optimization of manufacturing lines. This will lead to more adaptable, efficient, and cost-effective production systems, with the potential for future refinement based on real-time data and evolving industry needs.
10. **[ADRA/Manufacturing] Next-Generation AI for Robotics in Manufacturing** (joint outcome with Made in Europe Partnership)**:** The use of next-generation AI, including generative AI, will enhance robotics capabilities in manufacturing, enabling robots to better adapt to real-world environments and interact with human operators. This will allow for the repurposing of robotic systems to perform a broader range of tasks, optimizing workflows and improving flexibility in dynamic manufacturing settings. Integrating data-driven and physics-based models will enhance robot performance and enable deeper insights into causal relationships, improving the learning processes and factual correctness of multi-modal models.
11. **[Manufacturing] Industrial jobs transformed through natural and intelligent human-machine interfaces, including AI-driven systems**

    R&I on applications and operator support thanks to Generative AI and smart digitalisation at all levels of the factory. Activities should address data and its quality. Further advance is needed in the recognition of operator capabilities, also thanks to standardised modules for human digital twins, to boost human-machine collaboration and Human-AI teamwork. In addition to that, R&I should ensure a better Human-AI co-learning to foster knowledge sharing in the factory, continuous training, digitally enabled certification of workforce and up-skilling/re-qualification. New methodologies to co-design a new product with AI could be evaluated.
12. **[Manufacturing] New Industry business models lead to sustainable competitiveness - from volume to value**

    R&I on e.g. manufacturing as a service, improved decision making (including planning and scheduling of production) and process monitoring (including predictive maintenance) at factory level with the use of AI for more precise, efficient and flexible manufacturing of products, chemicals and materials leasing, circularity and value-added customer and end-user services, waste-to-value business models, and expanding the network of Hubs 5.0 for sustainable competitiveness.

B. Quantum

The Quantum Declaration, with which Member States have committed to collaborating with each other and with the Commission to develop a world-class quantum technology ecosystem across Europe, will form the basis for a European quantum strategy, including in R&I, that will shape the orientations in quantum for 2026-27 and beyond. R&I activities are thus expected to cover the following areas:

1. Support for world-leading **quantum research** covering basic quantum science and the key domains of quantum computing, quantum sensing, and quantum communication as a basis for research, innovation and preparing for industrialisation, and with a focus on strategic areas where Europe can capitalise on its existing strengths while building up competences that are currently lacking.
2. Furthering the development of a long-term EU Quantum Chips Plan to enhance Europe's capabilities in quantum technologies for closing the gap between research and industrial production of quantum chips. Activities would include support for experimental activities such as advanced materials and process innovation, for small-scale prototyping and alternative fabrication methods, for error correction and integration approaches, as well a for key enabling technologies like cryogenics and control electronics.
3. Building a quantum ecosystem that brings together startups, industry users, researchers, and infrastructure providers is essential to accelerate innovation, bridge the gap between research and commercialization, and ensure the development of a robust and competitive quantum industry, via support for the development of **innovative quantum applications** driven by user needs and of an enlarged European quantum ecosystem, with a focus on promising start-ups and scale-ups.

C. Photonics

Reinforce the leadership of European research and industry innovation in photonic technologies.

1. **Explore new trends in photonic integration and co-design with electronic integrated circuits** to bring down complexity and cost of production and to add new functionalities.
2. Push the boundaries towards **ultra-low-power photonic components and applications**.
3. Strengthen the **sustainable, environmentally friendly manufacturing of photonic components** and system.

Synergies with photonics-driven applications in areas such as health, industrial automation and manufacturing, automotive, farming and food industry, Data centres, communication and AI computing and quantum will be sought. Cooperation with the activities funded under the Chips Joint Undertaking will be encouraged.

D. Semiconductors

The Chips Joint Undertaking is the main vehicle under Horizon Europe to implement R&I activities in the semiconductor area and the bulk of R&I needs will be covered there.

1. Support the implementation of the EU Chips Act by **strengthening partnering and cooperation outside the EU to reduce and manage dependencies in the supply chain of EU actors**. Focus on emerging Semiconductor producing regions or countries such as India, Malaysia, Vietnam, Latin America.

2. Promote the use of non-hazardous materials in semiconductor manufacturing:
    a) Accelerate the development and adoption of safer alternatives to hazardous substances
    b) Emphasise the innovation on materials and production methods that enhance sustainability

E. Other Emerging Technologies

In addition to the actions around Innovative Advanced Materials under Destination 'Leadership in materials and production for Europe' above, the identification of challenges for emerging and future key technologies deserves specific support under Cluster 4.

DESTINATION Open Strategic Autonomy in Developing, Deploying and Using Global Space-Based Infrastructure, Services, Applications and Data

Addressing main policy priorities:

This last WP of the HE seven-year period will allow us to complete the main policy priorities under that period. These include:

- The continued development of the EU-owned space assets Galileo, EGNOS and Copernicus, each delivering important services to EU citizens and businesses and contributing to higher EU priorities such as the fight against climate change and digitalization; and the initial development of the new EU-owned space asset IRIS^{2,} also bound to delivering important services to EU citizens and businesses and contributing to higher EU priorities.
- The continued development of concrete applications in strategic areas for the data and services coming from those EU-owned space assets (agriculture, banking, construction, transport, etc.).
- The protection of EU-owned space assets through the development of space tracking & surveillance assets and capabilities.
- The development of new capabilities to maintain the competitiveness of the EU-owned space assets and that of the EU space industry, e.g. in-space operations and services capabilities; the development of autonomous EU access to space (launchers and launch pads); the development of EU non-dependence for critical space technologies, especially in light of the new geopolitical context; and the development of new capabilities for the EU to have a role in future space markets, e.g. quantum space gravimeters
- The provision of opportunities of in-space demonstration or validation for EU space innovations, and the provision of support (access to equity, development of skills, etc.) to the EU space start-ups and SMEs.

Draft expected impacts:

We will strive through WP 2026-27 and through the continuation of activities launched under the 2023-24 and 2025 WPs to **increase the capacity of the EU to**:

1. ***Access Space***, i.e. the ability to transport satellites, cargo, and humans into space; build and launch the required vehicles, including re-usable systems; and operate the related facilities and services.

2. ***Use Space on Earth***, i.e. the ability to provide space-based secure communication, navigation and Earth observation services and applications, including through the EU Space flagships Galileo, Copernicus and IRIS^{2}.

3. ***Monitor Space***, i.e. the ability to detect, track and anticipate the trajectory of spacecraft, near-Earth objects, and space debris during their full lifetime; to share data with relevant stakeholders; and to provide solutions for safe international space traffic management. It also includes the tracking and anticipation of other impacts on the space environment, such as space weather events.

4. ***Act in Space***, i.e. the ability to inspect, rendezvous and dock, grasp, repair, reconfigure, build, assemble and disassemble, reuse/recycle, relocate, remove and transport operational, non-operational, and other objects in space, including platforms or larger structures.

5. ***Explore Space***, i.e. the ability to conduct high profile space exploration activities, perform excellent science and exploit space data to increase our knowledge about the Universe and celestial bodies, with a view to their exploration for scientific and socio-economic benefits.

6. ***Boost Space***, i.e. the ability to sustain the above strategic capabilities through fostering the competitiveness of the EU space sector; improving education and developing the required skills; accelerating the pace of innovation; supporting EU non-dependency on critical technologies; and strengthening international cooperation.

Expected outcomes:

1. In ***Accessing Space***, enhance the resilience of European autonomous access to space via the diversification and competitiveness of the launch service offer. R&I actions will support the consolidation of new European launch solutions and prepare the ground for future European launch solutions. In addition, through the Space Partnership, actions will focus on activities in the domain of digital developments under the grand heading of *Digitalisation for Commercial Space solutions*. Actions will focus on a scope of activities supporting competitiveness for space transportation services, and aiming at enabling technologies to support a wider range of new systems and services building on previous HE and other EU actions.

2. Develop capabilities in ***using Space on Earth related to telecommunications***, through innovations related to end to-end flexible solutions, from large to medium and small satellites, on-orbit mission flexibility, ultra-high throughput capacities and enhanced cybersecurity. For IRIS^2, the last part of the development of the infrastructure and services. For GOVSATCOM, the development of critical building blocks in the satellite communication user segment terminals, such as for multi-orbit compatible broadband user terminals and government services user terminals. In addition, focus through the Space Partnership on cohesive activities in the domain of digital developments under the grand heading of *Digitalisation for Commercial Space solutions*. Under the area of using Space on Earth related to telecommunications, topics will address collaborative SatCom missions for space solutions (low/mid TRL and mid/high TRL).

3. In ***using Space on Earth related to Earth Observation***, focus through the Space Partnership on cohesive activities in the domain of digital developments under the grand heading of *Digitalisation for Commercial Space solutions*. Under this area of using Space on Earth related to Earth Observation, topics will address collaborative Earth Observation missions for Space solutions (low/mid TRL and mid/high TRL), more specifically digitalisation to maximize Observation imagery performance and timeliness.

4. In ***using Space on Earth related to satellite navigation***, continue to evolve Galileo and EGNOS infrastructure engineering and technology, including specific effort in support of Galileo 2nd generation (G2G) development (test user receivers to test the future G2G signals, engineering verification activities, technology de-risking) and of EGNOS v3. We will also seek further development of critical technology (e.g. atomic clocks, both space and ground clocks) through dual supply sources when feasible, and seeking technology diversity. Last, the development of new services will be pursued, such as EGNOS for non-aviation users (e.g. rail, maritime), or services based on the exploitation of 30+ satellites when combined with LEO.

5. In ***monitoring Space***, enhance Europe's strategic autonomy in the Space Surveillance and Tracking (SST) domain by focusing on increasing the generation of autonomous products (CDMs, fragmentation analysis…) delivered by the SST capabilities owned by the EU Member States and by private entities. By augmenting SST EU autonomy, contribute to improving EU decision-making, reduce reliance on external partners while at the same time strengthen the ability to cooperate with them. Specific efforts will be made to increase the generation of cost-effective autonomous orbits which will feed EU SST public services, including those handling multiples launches and fragmentation events. R&D activities will target improvements of the refresh rate of EU SST surveillance sensors, of the availabilities of tracking sensors, of sensors sensitiveness and accuracy and on the reactivity of the tasking loop. Support of the competitiveness of the European industry will also help commercial entities contribute to the generation of efficient autonomous situational awareness products.

6. When it comes to ***Acting in Space***, support enabling technologies for the future space ecosystem. A continuous maturation of promising, possibly disruptive enabling technologies is key to form the basis of space technologies and space applications for tomorrow. Concepts such as digital twins and virtual testbeds relying on advanced AI will change how technologies are designed and tested, reducing costs and development time and increasing design efficiency and the digitalisation of space systems.

7. When it comes to ***Boosting space through non-dependence of the EU for key critical space technologies***, we have deep knowledge of the critical space technologies affected by dependencies. This is based on information coming from EU Space missions and the EU Observatory of Critical Technologies. Complementary information is also provided through collaborations with EDA and ESA for space dual-use technologies. The activities will focus on the priorities stemming from those assessments and will be prioritized in response to EU Space missions.

8. When it comes to ***Boosting Space through developing innovative Space technologies for competitiveness***, pursue the development of the Quantum Space Gravimetry pathfinder mission aiming at demonstrating the technology in orbit.

9. When it comes to ***Boosting Space through IOD/IOV opportunities***, continue to provide in orbit demonstration and validation opportunities for experiments needing aggregation as well as for read-to-fly satellites. Aggregation, launch service and operations will be continued under the existing schemes, including through COM/ESA Flight Ticket Initiative.

10. When it comes ***to Boosting Space through support to entrepreneurship***, continue to support start-ups and of scale-ups through CASSINI, contributing to accelerating the pace of space innovation and making new products available on the market. There will be two actions in the 2026-27 WP.

11. When it comes ***to Exploring Space***, develop new exploration technologies and concepts for strategic and scientific exploitation, focusing on enabling technologies with sufficient reliability and innovative concepts for exploration activities aiming at strategic and scientific purposes. In the last years, we witnessed an increase in space missions based on small/nano-satellite platforms. These low-cost platforms may offer opportunities to develop low-cost missions also for the purpose of exploration e.g., to lunar orbit or surface.

12. Activities launched previously and not needing new topics or actions under the 2026-27 WP will continue to run and deliver outcomes. This includes activities under SST (Space Traffic

Management), SW (Space Weather) and NEO (Near-Earth Objects), GOVSATCOM use cases, Copernicus services evolution, Skills and EGNSS & Copernicus downstream applications.

DESTINATION Digital and industrial technologies driving human-centric innovation

Addressing main policy priorities:

The Political Guidelines put a strong emphasis on frontier technologies as new avenues of growth for the EU. Virtual Worlds represent such frontier technologies, combining AI, data, extended reality, connectivity, IoT that will bring massive opportunities across sectors and applications, from manufacturing to health to cultural and creative industries. The global market size is expected to grow from EUR 27bn in 2022 to EUR 800bn by 2030. The overarching aim of the EU strategy on Web 4.0 and virtual worlds is to guide the next technological transition that will heavily rely on the development of these frontier technologies and ensure novel, immersive and innovative digital environments are open, secure and trustworthy for all EU citizens, businesses, and public administrations. To this aim, the European Partnership on Virtual Worlds will foster excellence in research and develop an industrial and technological roadmap for virtual worlds, thereby supporting a cohesive European Virtual Worlds and Web 4.0 industrial ecosystem, strengthening European competitiveness.

A well-functioning European ecosystem of digital commons, based on open technologies and driven by European values, and a thriving culture of collaboration and social innovation are essential for ensuring sovereignty, trust and user empowerment.

Covered in this destination:

A. AI-DATA-ROBOTICS (including Partnership)
B. Virtual Worlds and Web 4.0 (Partnership)

Expected outcomes:

A. AI-DATA-ROBOTICS (Partnership)

Ensuring the safety of advanced AI systems: Focusing on both technical approaches (like automated testing, verification and interpretability) and fundamental design questions aimed at creating reliably safe AI systems.

B. Virtual Worlds – WEB 4.0 (Partnership)

Reinforce the leadership of European research and industry innovation in Virtual Worlds and Web4.0 technologies, including by leveraging digital commons.

1. **Develop innovative hardware components** for Virtual Worlds devices and applications, including display and optics components, sensors and actuators, with a focus on performance, reliability, miniaturisation, energy consumption and interoperability
2. **Support Excellence in core technologies for Virtual Worlds and Web4.0**, especially eXtended Reality, immersive and interactive technologies and bring full integration of Virtual Worlds and

Web4.0 technologies to the next level, including the use of GenAI for personalised experience and more natural experiences

3. **Create A thriving and competitive Virtual Worlds and Web4.0 ecosystem**, with the help the Virtual Worlds partnership.
4. An emerging **Web 4.0 architectural framework** made of cross-platforms, interoperable, trustable and secure, building blocks that rely on Open Source software produced and governed by communities of innovators and contributors – so called digital commons – driven by European values. The action will rely on the WP25 CSA output "Specific support for the Virtual Worlds Partnership and the Web 4.0 initiative"