# **Cluster 4 – Digital, Industry and Space**

**Draft V2 of the Work Programme 2023-24, updated version of 01/04/22 (building on V1 of 31/01/22)**

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# **Destination: Climate neutral, Circular and Digitised Production**

**Global leadership in clean, climate-neutral and resilient industrial value chains, circular economy and climate-neutral and human-centric digital systems and infrastructures (networks, data centres)**, through innovative production and manufacturing processes and their digitisation, new business models, sustainable-by-design advanced materials and technologies enabling the switch to decarbonisation in all major emitting industrial sectors, including green digital technologies.

This Destination will contribute to putting the EU on track for achieving climate neutrality of the industrial sector by 2050, while also reducing other polluting emissions, and for effectively promoting Europe’s independence from Russian fossil fuels before 2030 by means of more clean, efficient and sustainable industrial processes.

**Hubs for Circularity (H4C)**: The Hubs for Circularity (H4C) will be a key instruments to advance the research and innovation agenda of European industries towards the Green Deal’s objectives. These are first-of-a-kind, lighthouse demonstrator plants of (near) commercial size implementing industrial symbiosis and/or urban industrial symbiosis. Their aim is to collectively achieve and demonstrate at scale, a leap towards circularity and carbon neutrality in the use of resources (feedstock, energy and water) in a profitable way.

H4Cs have a strong technological focus and industrial dimension, but their implementation leverages elements well beyond research and innovation. Specific implementation (including funding) strategies will have to be co -designed, ensuring the participation of all stakeholders; industry, Small and medium-sized enterprises (SMEs), research and technology organizations (RTOs), local authorities, educational institutions and civil society.

## **Manufacturing Industry**

HORIZON-CL4-2024-TWIN-TRANSITION-01-01: Biological transformation of industries through advanced manufacturing (Made in Europe) (RIA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 4 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 35 million. |
| Type of Action | Research and Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected outcome:

* European manufacturing industries are reinforced through the adoption of biotechnologies and bio-intelligent principles; in particular
* Manufacturing industry gains access to bio-intelligent production technologies aiming at transforming materials (including biological materials) into manufacturing equipment or directly into functional products and components for upscaled production, addressing relevant Sustainable Development Goals (9, 12);
* Technological advances in, the integration of bio-intelligent principles, functions, structures and technologies in manufacturing.

Scope: The biological transformation of industry is a pioneering frontier that European and Associated Countries industries can harness to achieve their Green Deal Objectives while advancing production efficiency and competitive advantage.

Biological transformation of industries includes but is not limited to:

* bio-inspired manufacturing processes (biomimicry, biomimetics);
* Development of bioinspired systems for manufacturing;
* Expanding opportunities of bio-intelligent and bio-based materials by substitution fossil-based raw materials;
* a systematic application of the knowledge of nature and/or natural processes aiming at optimising a manufacturing system through a convergence and the integration of technical and biological processes.

This transformation can also aid in reducing the carbon footprint of production and products, and improve its circularity, while contributing to the competitiveness and digitalisation of the industry of the Union and Associated Countries.

Proposals need to demonstrate the development of digital and green technologies that facilitate the upscaled manufacturing of bio-based products in a variety of manufacturing value chains. In addition, sustainable business models need to be developed for production and recycling of the produced bio-based or bio-inspired products.

Proposals should address advanced manufacturing techniques (e.g. additive manufacturing, extrusion, moulding etc.) to process bio-materials and biotechnology components for upscaled production. Alternatively or concurrently, proposals should develop bio-inspired production technologies.

Proposals should address sectors where raw materials could be substituted by bio-based materials, or bio-based manufacturing operations, creating regenerative business models.

Pure materials development should however be excluded.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed, leveraging on existing ontologies and metadata and though the implementation of the FAIR data principles.[[1]](#footnote-2)

Additionally, a strategy for skills development should be presented, associating social partners and civil society where relevant.

All projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

This topic implements the co-programmed European Partnership Made in Europe.

HORIZON-CL4-2023-TWIN-TRANSITION-01-02: High-precision OR complex product manufacturing – potentially including the use of photonics (Made in Europe and Photonics Partnerships) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 5 and 7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 36 million. |
| Type of Action | Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. The following exceptions apply:  The funding rate is up to 60% of the eligible costs. This funding rate applies both to members and non-members of the partnership, except for non-profit legal entities, where the funding rate is up to 100% of the total eligible costs. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  To ensure a balanced portfolio covering all three technology areas in the scope below, grants will be awarded to applications not only in order of ranking, but also to at least one project in each technology area, provided that the applications attain all thresholds. |

Expected Outcome: Manufacturing industry will benefit from the following outcomes:

1. High-precision manufacturing and/or manufacturing of products with complex geometries, structure, number of components, embedded electronics, surfaces and surface functionalities and/or advanced materials;
2. Highly resilient and flexible production lines, enabling highly customised products down to lot size one, across a wide range of markets, and ensuring strategic autonomy for the manufacturing industry of the Union And Associated Countries.
3. Significant reductions in the use of materials, waste, defects and energy consumption.
4. Fostering the competitiveness of the European manufacturing industry, in general and (in the relevant projects) in the field of laser machine tools and within the laser markets in particular.

Scope: Products are increasingly complex, e.g. geometries, structures, embedded and structural electronics, micro- and nano-features or advanced and hybrid materials. Further constraints arise from new requirements of sustainability in production processes (resource and energy efficiency). In particular components and products have to be manufactured anticipating the fact that they would be disassembled, re-used, or re-manufactured or recycled.

To maintain technological autonomy and to enable the viable and sustainable manufacturing of high-tech products, innovative advanced manufacturing processes should be developed. Digital models make development, production, and operation of complex products manageable.

Proposals should address the following:

1. Advancement and demonstration of significant improvements in quality and precision in smart production technologies to manufacture complex products such as additive manufacturing, hybrid manufacturing, injection manufacturing, functional printing, intelligent and autonomous handling, shaping, joining, coating, and assembly technologies.;

OR

* Advancement in high-precision manufacturing technologies, including for example mechanical machining, thin film coating, etching and electrochemical machining, to achieve new product functionalities.

OR

* highly customised laser-based production including new and advanced methods, for example schemes of adapting laser beams and processes to provide a highly precise distribution of photons at the right place and at the right time.

Proposals may opt to combine two or three of the approaches above, provided there is added value in such combined approaches.

In all cases, process development will be required in order to demonstrate and validate the benefits the technologies in flexible and individualised manufacturing processes, minimising waste, defects and energy consumption; and enabling sustainable, innovative and improved products. The quality of the new products should be validated according to the most advanced metrology standards, and life cycle assessment should be considered.

The focus can be, for example, on addressing demands in healthcare, automotive, maritime and aviation industries, energy generation or environmental areas.

Proposals could additionally consider one or more of the following, provided this brings added value:

1. Use of novel sustainable and smart materials to achieve same or higher technical features in products while reducing environmental impact and waste;
2. Parallel product and manufacturing engineering, developing cyber physical systems, e.g. digital twins, to manage complex production using data spaces across the whole value chain;
3. Multiscale physics-based models and machine learning/AI methodologies to improve prediction capacity/optimisation in manufacturing, remanufacturing and reuse;
4. Management of data;
5. Develop suitable and traceable in-process process and dimension control.
6. Where relevant, contribute to a strong European materials ecosystem, through platforms allowing a systemic use of tools and capabilities including materials modelling, characterisation, robotics, data documentation, ontologies, artificial intelligence and machine learning, orchestrated to accelerate the design, development and application of chemicals, materials and related processes/manufacturing. Links with the CSA project HORIZON-CL4-2023-RESILIENCE-01-39 should be considered in this case.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Research must build on existing standards or contribute to standardisation. Where relevant, interoperability for data sharing should be addressed.

Additionally, a strategy for skills development should be presented, associating social partners where relevant.

All projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

This topic implements the co-programmed European Partnerships Made in Europe and Photonics.

**HORIZON-CL4-2023-TWIN-TRANSITION-01-03: Manufacturing as a Service: Customised production and services on demand, addressing customer needs and decentralisation (RIA)**

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 5 and 7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 35 million. |
| Type of Action | Research and Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected Outcome: Manufacturing industry will benefit from the following outcomes:

1. Availability of low-cost, industrial-grade technologies allowing to broaden the categories of products which can be custom-built on demand, at a price competitive with mass-manufactured products.
2. Integration of automation technologies allowing the flexible and distributed use of decentralised manufacturing and remanufacturing facilities, with minimal setup time and increased autonomy of systems and humans, reducing the required investments for manufacturers and the waste and emissions due to mass manufacturing and logistics.
3. Building customer-driven value networks, through technologies and models for collaborative product-service engineering and manufacturing.
4. Easy access to flexible and decentralised manufacturing and remanufacturing capacities, especially for SMEs.

Scope: Manufacturing as a Service (MaaS) is a distributed system of production in which resources (machines, data, software and human resources) are offered as services, allowing manufacturers to access distributed providers to implement their manufacturing processes. This topic aims at developing and integrating the technologies needed to make MaaS attractive under both technical and business perspectives, in the specific context of mass customised production. The high potential impact on the environmental, societal and business sustainability of manufacturing is due to the reduction of waste, the optimisation of logistics aspects, and the possibility to use state-of-the-art sustainable facilities for manufacturing and remanufacturing with limited upfront investments.

Proposals should integrate and further develop digital and other technologies allowing to manufacture “on demand” a large choice of customised products, with high flexibility and short lead time, by using distributed facilities as a service.

This will include the integration or development of the appropriate factory automation techniques including e.g., real-time, data-driven or digital twin technologies for the factory floor, to enable the automation of the complete cycle from the customer order to the delivery of the product, also by rapid re-purposing of manufacturing machines. Results should be demonstrated through at least one realistic use case.

Proposals should explain how the proposed approach contributes to the competitiveness of industry and the sustainability and circularity of production and logistics, through measurable targets. Product life cycle assessment should be considered.

Integration with digital design, development of design libraries and workflow templates, and prototyping techniques should also be considered, with the objective to optimise the entire lifecycle of the product in terms of circularity, sustainability and reusability. Proposals should take into account relevant activities supported under the Digital Europe programme, e.g., in the area of Manufacturing Data Spaces.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

This topic implements the co-programmed European Partnership “Made in Europe”.

HORIZON-CL4-2023-TWIN-TRANSITION-01-04: Factory-level and value chain approaches for remanufacturing (Made in Europe Partnership) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 5 and 7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 38 million. |
| Type of Action | Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. The following exceptions apply:  The funding rate is up to 60% of the eligible costs. This funding rate applies both to members and non-members of the partnership, except for non-profit legal entities, where the funding rate is up to 100% of the total eligible costs. |

Expected Outcome: Manufacturing industry should benefit from the following outcomes:

* Suitably scaled green and digital remanufacturing technologies that support circular value chains in industrial ecosystems;
* Remanufacturing of both components and products towards full circularity while maintaining functionality of components;
* •Skills and education capabilities for circular manufacturing and remanufacturing.

Scope:

Remanufacturing of both products and components is an essential step in achieving full industrial circularity. This calls for both remanufacturing technologies at the factory level and their integration into circular value chains, including the streamlining data to support remanufacturing. Remanufacturing should not be limited to the reuse of raw materials but should be aimed at reusing and upscaling components, valorising them and retaining their initial functionality.

Proposals should address technologies within industries and across industries:

* Develop cutting-edge remanufacturing technologies and their integration into value chains;
* Demonstrate remanufacturing processes that retain components functionality in at least three user cases;
* Develop, including through the possible use of digital twins, symbiosis in a variety of value chains contributing to circular economy and overall decarbonisation of European industries;
* Repurposing of components into a variety of industrial sectors.

A human-centric approach to remanufacturing should be integrated, with appropriate contributions from Social Sciences and Humanities (SSH); as part of this, a strategy for skills development should be included, associating social partners where relevant. This may include augmenting technologies and skills to strengthen the capabilities of the European workforce.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Proposals should take the relevant EU-regulatory framework (safety, SPI) into account.

Proposals should take into account any relevant activities supported under the Digital Europe programme, e.g. in the area of Manufacturing Data Spaces.

Where relevant, proposals should contribute to standardisation of relevant technologies.

All projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

This topic implements the co-programmed European Partnership Made in Europe.

HORIZON-CL4-2024-TWIN-TRANSITION-01-05: Technologies/solutions to support circularity for manufacturing (Made in Europe) (RIA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 4 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 36 million. |
| Type of Action | Research and Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected Outcome: Manufacturing industry should benefit from the following outcomes:

* Manufacturing industries will be enabled to assess the environmental impact of their products, including the flow of products after their use, as well as market demands, to reduce product and raw material waste with the support of digital technologies;
* Manufacturing will be enabled to achieve a considerable net reduction of the ecological impact through the use of innovative modelling and simulation software that allow real time process control as also transport and manufacture monitoring;
* Remanufacturing will be facilitated by the development and uptake of digital tools/platforms such as the EU Digital Product Passport, to increase traceability and characterisation of materials and products (e.g. at analytical research infrastructures), including environmental footprint and quality;
* Barriers in the uptake of the digital tools from the market will be addressed and the workforce will be empowered through new digital skills;

Scope:

Manufacturing plays a key role in achieving the twin transition goal through enhancing circularity, facilitating decarbonisation and enhancing competitiveness. A broad range of digital technologies and engineering tools can be employed to achieve the systemic circularity of the European manufacturers.

Predictive and data analytics can process a huge amount of data achieving a much deeper understanding of customer needs as also the state of the products after their use. Advanced simulation tools integrated in the design process and the digital monitoring of the manufacturing process can optimize (through improved decision-making) the whole value chain from chemistry, raw and advanced materials through manufacturing and distribution (transport of goods) to the consumer.

Data pooling and sharing among sectors and across the whole value chain, as well as the use of digital twins, and external environmental impact data such as LCA-data, would facilitate recycling and remanufacturing, by modelling and monitoring the life cycle of products and components. To achieve that there is a need to build trust by ensuring data exchange and interoperability across industry sectors and relevant stakeholders, while also focusing on aspects like data quality, cybersecurity, reliability, and accessibility. The forthcoming Sustainable Product Initiative (SPI) that has been announced as part of the Circular Economy Action Plan 2.0 in 2020 is proposing the Digital Product Passport to electronically register, process and share product-related information amongst supply chain businesses, authorities and customers, therefore the manufacturers should be prepared for its implementation.

All the technological improvements of the manufacturing process should always support the human aspect in order to uptake these improvements through upskilling and reskilling of the manufacturing workforce.

Proposals should cover all of the following aspects:

* Develop new approaches of Artificial Intelligence to enhance the predictive manufacturing capabilities and logistics based on the changing market needs, forecasts of environmental impact, and also considering the quantity and state of products after their use.
* Develop innovative simulation and modelling software fostering new creative manufacturing capabilities and increasing productivity with a view to a more efficient and more sustainable product design. This optimization process should consider the various steps of the value chain focusing on the ecological impact. Additional ecological impacts arising from the use of the modelling or simulation software should be considered.
* Develop digital platforms or tools that will enable the manufacturers to implement the Digital Product Passport initiative. The proposals should focus on gathering relevant data, material and product tracking and tracing, certification protocols for secure re-used materials and components among sectors.

International cooperation is encouraged, especially with Japan and S. Korea.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Projects should contribute to achieve a strong European materials ecosystem through platforms allowing a systemic use of tools and capabilities including materials and processes modelling, characterisation, robotics, data documentation, ontologies, artificial intelligence and machine learning, orchestrated to accelerate the design, development and application of chemicals, materials and related processes/manufacturing. Links with the CSA project HORIZON-CL4-2023-RESILIENCE-01-39 should be established.

Proposals should take into account relevant activities supported under the Digital Europe programme, e.g. in the area of Manufacturing Data Spaces.

Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed, leveraging on existing ontologies and metadata and though the implementation of the FAIR data principles.[[2]](#footnote-3)

All projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. Projects should take into account relevant activities supported under the Digital Europe programme, e.g. in the area of Manufacturing Data Spaces

This topic implements the co-programmed European Partnership Made in Europe.

**HORIZON-CL4-2024-TWIN-TRANSITION-01-07: Manufacturing As A Service: Flexible manufacturing in resilient value networks (RIA)**

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 4 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 32 million. |
| Type of Action | Research and Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 3 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Availability of reliable models, digital simulators (digital twins) and control tower technologies for specific value networks, providing timely scoreboard views and enabling a better understanding of the impact of unforeseen events on manufacturing and industrial production.
* Availability of technologies to swiftly adapt the production of goods and services to varying external conditions, improving the resilience of the industrial systems towards fragility of value chains, and the sustainability of the entire production process, e.g., through continuous improvement.
* Industrial organisation models and smart factories that are resilient and capable of self-adaptation in response to external threats, possibly following bio-inspired approaches.

Scope: Manufacturing as a Service (MaaS) is a distributed system of production in which resources (machines, data, software and human resources) are offered as services, allowing manufacturers to access distributed providers to implement their business processes. This topic aims at exploiting the advantages of MaaS by leveraging the intrinsic flexibility and resilience provided by the possibility to use distributed and programmable manufacturing resources on demand, under real-world conditions characterised by high volatility of the supply.

Proposals should develop realistic models of value chains, which allow humans to react timely and better understand the impact of external events on the industrial system, and to propose simulations and scenarios that will appropriately respond to those events and optimise industrial production.

The results of simulations should be explainable for humans, and lead to instructions for automated manufacturing and re-manufacturing facilities that can implement the retained scenarios and adapt production processes, stock levels and any other variables of the manufacturing and logistic flow, optimising production in terms of resilience, agility, and circularity. Collaborative engineering tools will support the management of distributed production processes under frequently changing conditions in a complex value network.

Resiliency to failures should be taken into account, resulting in the capability to guarantee useful outputs and reliable production even under non-optimal conditions. Multidisciplinary research activities should address the way to develop robust models on the basis of uncertain and incomplete data, and to translate those models into practically usable digital twins, which can produce actionable information and instructions.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination, and demonstrate their results through at least two realistic use cases.

Proposals should address primarily the aspects related to data and digital technologies, possibly complementing activities supported in other relevant topics like e.g., “Systems integration and resilient supply chains in manufacturing”.

The results will contribute to making Manufacturing As A Service technically and economically viable, and are expected to improve to both the competitiveness of industry and the circularity and sustainability of the production/logistic processes. Proposals should explain how the proposed approach contributes to these objectives through measurable targets.

This topic implements the co-programmed European Partnership “Made in Europe”.

**HORIZON-CL4-2024-TWIN-TRANSITION-01-08: Foresight and technology transfer for Manufacturing As A Service (CSA)**

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of up to 1 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 1 million. |
| Type of Action | Coordination and Support Action |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Focused strategic foresight relevant to Manufacturing as a Service and digital technologies in manufacturing, namely (1) analysis of the best practices to advance circularity, decarbonisation, sustainability and resilience of industrial production in the context of a “Manufacturing as a Service” approach, (2) analysis of foreseeable developments and trends, including the potential advantages and disadvantages, regarding distributed manufacturing as a service vs. centralised manufacturing for different categories of products relevant for the EU industry and (3) roadmapping for EU industry to transform and anticipate these changes.
* Support for the transfer of information and technologies between Horizon Europe projects and other relevant initiatives, e.g., the Manufacturing Data Spaces and the network of European Digital Innovation Hubs.

Scope: Manufacturing as a Service (MaaS) is a distributed approach to production in which resources (machines, data, software) are offered as services, allowing manufacturers to access distributed providers to implement their processes and logistics.

Proposals should develop strategic advice on best practices strategies for the future evolution of the MaaS approach, roadmapping for EU industry to anticipate these changes and support the research and innovation activities in this area, making available to the community of practitioners the information needed to interact with relevant initiatives like the Manufacturing Data Spaces and the European Digital Innovation Hubs.

The activities will include the organisation of events and workshops on technology transfer and collaboration, with a specific focus on best practices to support circularity and sustainability in industrial production through digital technologies in a “Manufacturing as a Service” context.

Only one proposal will be selected for funding.

This topic implements the co-programmed European Partnership “Made in Europe”.

## **A New Way to Build, accelerating disruptive change in construction**

**HORIZON-CL4-2023-TWIN-TRANSITION-01-11: Intelligent data acquisition and analysis of materials and products in existing built works (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 5 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 12 million. |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcomes:

* Faster and less labour-intensive identification, analysis and digitisation of materials and products from existing built works
* Increased supply of secondary materials and construction products for reuse
* Reduction in construction and demolition waste
* Improved facility to re-use and repair construction products
* Improvements to labour productivity as a result of using the developed solutions

Scope:

Existing built works (buildings and infrastructure) can potentially act as a significant ‘material bank’, providing a rich source of secondary materials and products for construction. This requires identification and analysis of the asset’s components and materials, which typically involves slow, labour-intensive and costly processes. There is a need to research new digitally powered techniques and technologies that would rapidly and accurately identify, analyse and record existing construction materials, products and components, facilitating their use in a circular economy and reducing life cycle impacts including embodied carbon. Proposals would thus contribute to the aims of the New European Bauhaus.

Proposals should:

* Develop new techniques and technologies to rapidly identify materials, construction products and components of existing built works, or works that have undergone demolition
* Develop solutions that would rapidly analyse the properties and characteristics of materials, construction products and components, which may include for example material composition, dimensions, mass, technical/mechanical properties and performance, health and safety aspects such as performance in case of fire and the presence of hazardous substances such as asbestos, fixing methods, repair needs, or other aspects
* Develop solutions to digitally record, categorise and tag existing materials, construction products and elements for their eventual use on the market and inclusion in relevant software tools and databases. Proposals should also support the development of existing tools and databases, where relevant, and ensure that relevant actors across the construction ecosystem are consulted in their development, and take into account SSH aspects of this.
* Develop solutions that would analyse the suitability of identified elements for use in a circular economy including undergoing appropriate reuse, repair or recycling processes, or conversely to label them as waste including the necessary separation and sorting
* Research ways in which complex or concealed elements can be identified and analysed, for example materials within the make-up of walls and floors, hidden structures, or composite products
* Address ways to make circular use of the identified elements as secondary materials or reused products on the market in construction projects, and to track them and their characteristics over asset life cycles
* Address ways in which the characteristics of identified elements could be presented in a user-friendly manner to relevant actors such as construction professionals, including on-site workers, designers, architects and developers. This should include consideration of SSH and business model aspects.
* Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed, for example in relation to product databases and cross-border collaboration.
* Additionally, a strategy for skills development should be presented, associating social partners where relevant, integrating SSH aspects and including relevant tools such as MOOCs (massive open online courses).
* Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms, such as the New European Bauhaus, data spaces under the Digital Europe programme, or the Built4People partnership under Horizon Europe.
* Proposals should seek to integrate insights from social sciences and humanities to maximise economic and social impact.

**HORIZON-CL4-2024-TWIN-TRANSITION-01-12: Enhanced assessment, intervention and repair of civil engineering infrastructure (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 5 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 12 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcomes:

* Extension of the service life of civil engineering infrastructure
* Faster and more accurate detection and analysis of maintenance and repair needs in existing infrastructure
* Reduction in time between the occurrence of infrastructure maintenance and repair-related problems and the on-site intervention
* Reduced risks to health and safety of workers in carrying out tasks linked to infrastructure maintenance and repair
* Cost savings in terms of both operational costs and deferred or avoided capital investment costs

Scope:

Regular maintenance and repair of civil engineering infrastructure extends their service life, which in turn reduces the need for their demolition and replacement and the related negative economic and environmental impacts. However, it can be difficult and cumbersome to identify and address maintenance or repair needs, especially in locations that are difficult to access such as large or tall structures, deep shafts, or where elements are hidden from view. Intervention for maintenance and repair can also involve unnecessary risks to health and safety of workers.

Proposals should:

* Develop new technologies and solutions that facilitate timely identification of maintenance and repair issues in existing civil engineering infrastructure. Examples may include structural weaknesses, unacceptable deformation and fatigue, issues related to moisture including mould growth and corrosion, the effects of weathering and of weather-related events, faults in technical systems, leaks of water or chemicals, or other issues.
* Develop new solutions to monitor and to quickly and accurately analyse and assess the need for intervention, for example via digital twin and simulation technology
* Develop solutions that would intelligently recommend and prioritise relevant and timely action to address the identified maintenance and repair issues. This should include a risk assessment and application of state of the art quality controls and documentation.
* Develop solutions that would carry out rapid, cost effective and safe intervention for maintenance and repair of infrastructure, for example using automated or remotely operated tools, or next generation egocentric AR solutions
* Address ways to reduce the risks involved with maintenance and repair, including the health and safety of workers
* Address ways to digitally record and continually update the maintenance and repair status of infrastructure assets and their component parts
* Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.
* Additionally, a strategy for skills development should be presented, associating social partners where relevant, integrating SSH aspects and including relevant tools such as MOOCs (massive open online courses).
* Proposals should build on or seek collaboration with existing projects or solutions and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms, such as the New European Bauhaus.
* Proposals should seek to integrate insights from social sciences and humanities to maximise economic and social impact, including considering how workers carry out tasks and respond to safety issues.
* Improved facility to re-use construction products
* Existing built works, fixing methods, or other aspectssolutions to digitally record categorise and tag existing materials, construction products and elements for their eventual use on the market
* Interoperability for data sharing should be addressed.
* Additionally, a strategy for skills development should be presented, associating social partners where relevant.build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms, such as the New European Bauhaus.
* **HORIZON-CL4-2023-TWIN-TRANSITION-01-12: Enhanced assessment, intervention and repair of civil engineering infrastructure (RIA)** Develop new solutions to quickly and accurately analyse and assess the need for intervention
* Develop solutions that would intelligently recommend and prioritise relevant and timely action to address the identified maintenance and repair issues
* Develop solutions that would carry out rapid, cost effective and safe intervention for maintenance and repair of infrastructure, for example using automated or remotely operated tools
* .
* Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms, such as the New European Bauhaus.

## **Energy Intensive Process Industries**

Energy efficient and climate neutral process industries

HORIZON-CL4-2023-TWIN-TRANSITION-01-31: Energy efficiency breakthroughs in the process industries (Processes4Planet partnership) (RIA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 8 and 10 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 32 million. |
| Type of Action | Research and Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected Outcome: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by designing and digitising industrial processes for a maximum energy efficiency, ensuring process flexibility and capturing the full potential of renewable energy (related to P4Planet operational objectives 1 and 5)

Projects are expected to contribute to the following outcomes:

* Energy intensive industries will achieve a step change in energy efficiency of industrial processes by reducing at least 30% of the energy use as compared to current state of the art;
* Prove the techno-economic feasibility of novel technologies and processes, validated and demonstrated at suitable scale against current industrial processes;
* Enable the potential of an increased use of renewable energy;
* Contribute to achieving EU climate neutrality goal and reduction of fossil fuel imports dependency

Scope: To decarbonise the energy-intensive industries both, the availability of affordable renewable energy, and the increase of the industrial processes energy efficiency, will be needed. Today‘s energy efficiency improvements in conventional plants are about 1-2% annually. The use of digital technologies in process optimisation has the potential to further reduce this energy demand. However, digital technologies alone cannot achieve the required step change in the process industries energy efficiency, their combination with highly energy efficient process breakthroughs will be needed.

Proposals under this topic should:

* Focus on the development of highly efficient technological breakthroughs for the innovation of the most energy intensive parts of specific processes;
* Demonstrate the decrease of energy intensity of output level (intermediate, final product);
* Integrate novel digital technologies from the fields of distributed process control and data driven AI based optimisation;
* Demonstrate and evaluate energy efficiency gains, where relevant in optimal interaction with energy flexibility and integration of renewables.

The proposals should include energy efficiency, techno-economic and life-cycle assessments considering the overall process.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. Particular attention should be given to outcomes from the projects carried out in the call DT-SPIRE-06-2019: Digital technologies for improved performance in cognitive production plants.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2024-TWIN-TRANSITION-01-32: Optimisation of thermal energy flows in the process industry (Processes4Planet partnership) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 10 and 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 30 million. |
| Type of Action | Innovation Actions |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G.   Lump sum |

Expected outcomes: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by enhancing process industries energy efficiency, ensuring process flexibility and capturing the full potential of renewable energy (related to P4Planet operational objective 1).

Projects are expected to contribute to the following outcomes:

* Energy intensive industries will be enabled to increase their energy efficiency through optimisation of thermal energy flows between processes, minimizing losses and using all levels of energy;
* Demonstrate highly process-integrated solutions that offer better opportunities to increase efficiency and reduce investment cost of high temperature installations;
* Demonstrate a substantial increase in flexibility of the processes;
* Contribute to achieving EU Climate neutrality goals and reduction of fossil fuel imports dependency

Scope: More than 60% (ref. Sintef report) of the overall energy used in the process industry is process heating. The topic focus would be on highly process-integrated technologies that allow heat recovery and use on high temperature installations. Heat storage when needed should be intermediary only. One example could be the adaptation and integration of heat pumps for high temperature (150-250C) applications for large thermal capacity (~1-20 megawatt), but not only – examples could also encompass the direct use of excess heat by e.g. the adaptation and integration of advanced heat exchangers.

The proposals under this topic should:

* Demonstrate the efficient integration and adaptation of heat exchanger or heat pumps on existing high temperature processes and equipment taking energy not only from air but also warm materials or liquid flows;
* Use high safety standard technologies and fluids with low environmental impact;
* Consider the use of advanced materials in the process development;
* Demonstrate the decrease of energy intensity of output level (intermediate, final product);
* Analyse the competitiveness and cost efficiency of the proposed solutions;
* Include a GHG avoidance methodology[[3]](#footnote-4) that provides detailed description of baselines and projected reductions;

Proposals submitted under this topic should include a sound business case and strong exploitation strategy, as outlined in the introduction to this Destination. The exploitation plans should include preliminary plans for scalability, commercialisation and deployment (feasibility study, business plan).

The proposals should exclude the heat power generation, being already addressed in Cluster 5.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2023-TWIN-TRANSITION-01-33: Electrification of high temperature heating systems (Processes4Planet Partnership) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 12 and 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 36 million. |
| Type of Action | Innovation Actions |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected outcome: Projects outcomes will enable achieving the objectives of the Processes4Planet partnership, and the transition of the process industry towards climate neutrality, by developing new electrified processes, ensuring process flexibility and capturing the full potential of renewable energy (related to P4Planet operational objective 1).

Projects are expected to contribute to the following outcomes:

* Demonstrate the use of advanced electric heating technologies for process industry for high temperature demand systems;
* Prove the effectiveness of the technologies towards GHG emission avoidance;
* Reduce process emissions of high temperature heating systems by at least 30% compared to current state of the art levels of the process with fossil-based heating system;
* Enable the integration of renewable electricity in process industries to substitute fossil fuels for heating, thereby reducing fossil fuel imports dependency;
* Prove the economic viability of the entire unit to compete with the fossil-based heating systems;
* Showcase the effectiveness of the GHG emission avoidance in the process industries as well as the scalability and the cost efficiency of the proposed solutions;
* Increase the competitiveness and resilience of the European process industry.

Scope: High temperature (over 400°C) industrial heating systems, powered by fossil fuel combustion, are responsible of 20% of process industries GHG emissions. Electrification of these heating systems with renewable electricity could represent a major reduction of the related GHG emissions. The topic focuses on the sustainable electrification of high temperature heating systems, for example, industrial furnaces, kilns and crackers among others.

The proposals should:

* Integrate existing highly efficient technologies, e.g., (not exhaustive) induction heating, hybrid operation between electric heating and zero-carbon fuel heating microwave and plasma technologies, electric resistances, and/or the combination with digital technologies or hybrid modelling; this may include the development of high temperature heat storage for flexible usage of electricity (load shifting) or renewable electricity production (production fluctuation);
* Take a holistic approach which may include aspects such as advanced materials requirements and appropriate equipment design;
* Improve the process safety, flexibility, and ease of process control;
* Showcase the improved performance through at least one realistic use case that can be replicable in more than one process industry sector with demonstrable economic return.

Proposals should include a GHG avoidance methodology[[4]](#footnote-5) that provides detailed descriptions of baselines and projected emissions reduction.

Proposals submitted under this topic should include a strong business case and sound exploitation strategy, as outlined in the introduction to this Destination.The exploitation plans should include preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan) indicating the possible funding sources to be potentially used (e.g. Innovation Fund, InvestEU, ESIF).

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programs and platforms and are encouraged to consider the use of their expected outcomes in a wider approach that might benefit the establishment of Hubs for Circularity.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2024-TWIN-TRANSITION-01-34: Renewable hydrogen used as feedstock in innovative production routes (Processes4Planet Partnership) (RIA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 8 and 10 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 20 million. |
| Type of Action | Research and Innovation Action or Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected outcomes: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by developing new processes integrating renewable hydrogen replacing fossil feedstock-based processes, enabling the full potential of renewable energy sources, and ensuring process flexibility (related to P4Planet operational objectives 1 and 2).

Projects are expected to contribute to the following outcomes:

* Showcase the technical and economic feasibility of innovative production routes using hydrogen as feedstock[[5]](#footnote-6) demonstrated and validated at suitable scale against current industrial processes;
* Enable the efficient use and integration of hydrogen as a feedstock in innovative process industry, considering also fluctuation of availability;
* Support the increased utilisation of renewable energy sources combined with digital technologies in process industries, thereby reducing fossil fuel imports dependency;
* Contribute to EU Climate neutrality goals by proving the effectiveness of the GHG emission avoidance in the targeted process;
* Support Mission Innovation 2.0 NZEID on ‘Net-zero Industries’ and its ambition via networking and dissemination activities.

Scope: Hydrogen produced from renewable energy sources does not lead to direct carbon dioxide emissions when used and it can offer solutions to decrease GHG emissions in industrial processes, being an important enabler to meet the 2050 climate neutrality goal. In the energy intensive process industries hydrogen can be used either as feedstock (chemical or reducing agent) or as an energy carrier. The integration of renewable hydrogen into new production routes as a feedstock will lead to major GHG emission reductions across several European industry sectors.

Nowadays, hydrogen is largely used in industrial sectors such as the chemical industries and refineries. In addition to the current processes, there are different production pathways under development using hydrogen as a chemical feedstock in low-carbon industrial processes. Hydrogen could be used as reducing agent in the production and recovery of metals, biogenic and circular carbon optimisation or in new process routes to produce platform chemicals (e.g., carbon-based waste and side streams or biomass). Using renewable hydrogen as feedstock in these new processes will lead to major GHG emission reductions.

The proposals under this topic should:

* Develop innovative production routes using hydrogen as feedstock;
* Evaluate the efficient integration of the new production process into the processing line, including downstream and upstream;
* Prove techno-economic viability of the process, which will be impacted by several parameters including the efficient use of the hydrogen as well as the value of the by-products, and the value chain from hydrogen production, storage, distribution and usage;
* Design, by making the best use of simulation, modelling and IT tools, of the production process coupled/integrated with renewable hydrogen.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives and funding programmes and platforms. Where relevant, proposals could liaise with the Clean Hydrogen Joint Undertaking and are encouraged to contribute and participate to the activities of the TRUST database and the hydrogen observatory.

The use of hydrogen as feedstock for the production of fuels covered by Cluster 5 is out of the scope of this topic.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2024-TWIN-TRANSITION-01-35: Turning CO2 emissions from the process industry to feedstock (Processes4Planet partnership) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 10 and 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 30 million. |
| Type of Action | Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 5-6 and achieve TRL 7 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G.  Lump sum |

Expected outcomes: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by developing efficient CO/CO2 capture and purification technologies, in combination with valorisation routes; and driving the partnership’s innovation portfolio towards first of a kind demonstrator to de-risk investment (related P4Planet operational objectives 3, 4 and 9).

Projects are expected to contribute to the following outcomes:

* Master the capture, purification and conversion of CO/CO2 from process industries point sources and renewable energy at reasonable costs to pave the road to the production of a large range of chemicals and materials;
* Showcase the system effectiveness for the GHG emission avoidance in the process industries as well as the scalability and the cost efficiency of the proposed concept;
* Enable the economic viability of the entire unit to compete with the existing production (e.g. fossil-based production of chemicals);
* Prove the efficient integration and use of renewable energy sources, where relevant considering also their intermittency and the possibility to offer demand-response flexibility;
* Increase the competitiveness and resilience of the European process industry.

Scope: The proposals submitted under this topic are expected to demonstrate the techno-economic viability of the efficient capture and utilisation of CO/CO2 streams from point sources (e.g., large industrial installations such as steel, cement, refining and chemical plants) converting them into added value chemicals. and materials in near to production size systems. The technologies proposed should support cross-sectorial concepts and sector integration. The semi-industrial pilot plant demonstrators proposed should:

* Process significant amounts of CO/CO2 containing emissions from energy intensive process industries;
* Demonstrate process and cost efficient environmentally friendly technologies for: capture (e.g., use of waste heat in scrubbers, increased mass transport in intensified scrubbers, electrified systems with promising novel materials and equipment design); fit for purpose purification approaches (e.g., advanced membranes and environmental friendly absorbents for cleaning formulations, compression, drying, concentration, Pressure Swing Adsorption etc.); while ensuring the maximum process efficiency;
* Demonstrate process and cost efficient environmentally friendly conversion of CO/CO2 into chemicals and materials (e.g., formulation of reliable catalyst at the required scale) including if relevant process-integrated downstream products;
* Evaluate the energy efficiency for the overall CCU process and where relevant flexibility considerations for the efficient use of renewable energy for capture and conversion.;
* Encompass the use of advanced monitoring and control techniques and integration of advanced digital technologies, which enable optimisation of the overall system;
* Contribute to an integration effort to realize full cell architectures, including the optimization of materials, interfaces, electrodes, and ultimately device architectures and to promote maximum energy efficiency;
* Include techno-economic analysis, including social and environmental impact.

The proposals will integrate technologies to make them practically and economically viable in the process industries reducing CAPEX and CO2 abatement costs. This should be demonstrated through at least one realistic use cases with demonstrable economic return developed in closed cooperation between CO2 industrial emitters, users and technology providers.

The inclusion of a GHG avoidance methodology[[6]](#footnote-7) is recommended, and should provide detailed descriptions of baselines and projected emissions reduction.

Proposals submitted under this topic should include a strong business case and sound exploitation strategy, as outlined in the introduction to this Destination. The exploitation plans should include preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan) indicating the possible funding sources to be potentially used (e.g. Innovation Fund, InvestEU, ESIF).

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms and are encouraged to consider the use of their expected outcomes in a wider approach that might benefit the establishment of Hubs for Circularity.

This topic is complementary to the topic CL5, D3-3-2: CCU for the production of fuels.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2023-TWIN-TRANSITION-01-36: Modelling process industry transition to climate neutrality, sustainability and circularity (Processes4Planet partnership) (RIA)

Expected Outcome:

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 8 and 10 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 10 million. |
| Type of Action | Research and Innovation Actions |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G.  Lump sum |

Expected Outcome: Projects outcomes will enable the achievement of the objectives of Processes4Planet partnership by contributing to new framework conditions to generate a market for climate neutral and circular solutions (related P4Planet operational objective 10).

Projects are expected to contribute to the following outcomes:

* Development of a model, enhancement of existing modelling tools[[7]](#footnote-8) towards understanding the pathways for industry to contribute to EU’s climate neutrality;
* Modelling of scenariosof possible pathways of how EII and other industries can become climate neutral according to the following five dimensions:(1) their energy consumption and energy efficiency, (2) their process emissions; (3) in use of materials, chemicals (i.e. via increasing use of bio-based materials, circular approaches and material substitution also in view of ensuring affordability of industrial products) and fewer water demand (mastering water scarcity); (4) consumer goods/equipment/construction products (i.e. looking at sustainability of products[[8]](#footnote-9) and embedded carbon – a preliminary approach only); (5) possibility of replacing fossil carbon in materials by more sustainable streams of recycled carbon from waste, sustainable biomass and directly from the atmosphere[[9]](#footnote-10).
* Contribution to future EU and national industry, climate and energy policy assessments. Climate neutrality of industry will be a strong priority for the EU and national policies by 2030 and towards 2050 as it is considered as hard-to-abate sector[[10]](#footnote-11). Any policy initiatives on the EU or national level will require a robust, forward-looking analytical basis interlinked with macro-economic and energy system trends and such can be provided by modelling;
* Contribution to setting the climate neutrality transition pathways for process industries in an open and transparent manner via design, modelling and assessment of pathways for these industries. Modelling exercises can set the framework conditions and project market uptake of transformative solutions and products;
* Contribution to enhancing the knowledge about climate neutrality pathways for industry for all stakeholders and academia as the resulting modelling capacity (model code) and input data should be fully transparent and published under an open-source licencing.

Scope:

**Development of the model**

Currently the modelling tools to represent EU industry’s pathways to climate neutrality are not fully developed. The new modelling capacity should cover historical development starting 1990 and projections up to 2070 for EU and Associated Countries altogether and each Member State separately as well as for European Economic Area. according to the following five dimensions outlined in the expected outcomes considering: that materials, chemicals and goods are sourced and traded globally, or at least regionally, global sourcing and trade has to be captured with relevant granularity and based on exogenous assumptions and/or links with global trade models;. that industry’s links with other sectors of the economy, innovative ways have to be found to integrate such capacity in a fully consistent energy system picture and to link it with broader macro-economic developments (notably as far as demand for industrial products is concerned) and meta-trends such as digitalisation.

The proposals should deliver modelling built in a modular manner progressively delivering an integrated modelling capacity able to produce first results available for review by the project midterm.

The proposals should be built in a modular manner and progressively lead to the development of an integrated modelling capacity allowing to capture the economics and behavioural aspects of demand, production and trade of materials, as well as techno-economic trajectories of the industrial sectors identified above. That would include (but not necessarily limited to) concepts from system dynamics modelling (for materials flows and stocks), techno-economic modelling (for the economics of production costs, elasticity of demand or trade effects), macro-economic modelling (socio-economics impacts), as well as agent-based modelling (choices of materials or technologies).

The proposals as a part of its governance and validation will enable to involve relevant stakeholders, participate in peer-review processes, scientific conferences and publish in scientific journals and create possibilities for a feedback loop from stakeholders. The model should be continuously developed based on the feedback from stakeholders.

**Modelling of scenarios**

Secondly, the proposals should deploy this new modelling capacity to explore, through the development of several “what if” scenarios, capturing all dimensions mapped above in a consistent way. The scenarios produced with the model should be contrasted but self-consistent political, policy and economic contexts, presenting different pathways for climate neutrality transition in terms of energy needs, addressing the process emissions as well needs and supply of material and technological options to produce the materials in needed quantities. In addition, a preliminary approach for tracing the carbon embedded in products and replacing fossil carbon in materials should be explored.

Processes4Planet’s Horizon Europe public private partnership ambition is to achieve a profound change in the way the materials that citizens need to sustain their quality of life. are produced and consumed. Processes4Planet is about transforming European process industries to make them circular and achieve overall climate neutrality at EU level by 2050, while enhancing their global competitiveness. Proposals should ensure the adequate involvement of the partnership advisory bodies i.e., “Impact Panel” and, as social innovation is concerned, the “feedback panel”.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms e.g. the Energy and Industry Geography Lab of the Joint Research Centre.

Circularity and Zero Pollution in process industry

HORIZON-CL4-2023-TWIN-TRANSITION-01-37: Hubs for circularity for near zero emissions regions applying industrial symbiosis and cooperative approach to heavy industrialized clusters and surrounding ecosystems (Processes4Planet partnership) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 15 and 20 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 40 million. |
| Type of Action | Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by demonstrating hubs for circularity (H4Cs) concepts[[11]](#footnote-12), fostering circularity within and beyond process industries and driving the partnership’s innovation portfolio towards “First of a kind” demonstrators to de-risk investment for subsequent roll-out. (P4Planet operational objectives 8 and 9).

Expected outcomes: Projects are expected to contribute to the following outcomes:

* Process industries will achieve a step change in circular utilization of resources by reaching at least 20% of reduction use of virgin resources (materials, energy and water) as compared to current state of the art;
* Use industrial symbiosis and cross-sectorial cooperation to pave the way for achieving the EU Green Deal and “Fit for 55” package objectives;
* Citizens living in proximity of heavily industrialized clusters will benefit from a healthier industrial/urban symbiosis by having less emissions through circular and renewable energy sources;
* Implement a social innovation spin-off action [1] involving one of the local community actors and additional actions to facilitate relations and to involve the local community actors e.g. exchanging knowledge and human capital with the educational establishments and developing flexible learning resources;
* Provide recommendations for optimized regional framework conditions by highlighting barriers and suitable innovation-oriented policies.

Important: the targets are meant to be achieved collectively by the region/area concerned, not only by consortium members.

Scope:

A large industrial symbiosis near commercial scale demonstrator should illustrate place-based innovation from local and regional perspectives, integrating infrastructures (e.g., industrial waste, by-product and water management infrastructure, fluid flow networks, digital infrastructure), energy network and grids (for e.g., smart operations scheduling, district heat integration, digital power plant including distributed generation, seasonal storage, biomass, and heat pumps integration). Industries involved should boost their resource efficiency, heat recovery, and transform to use RES, hydrogen as an energy carrier, or support the implementation of CCU locally or prepare for CCS logistics. The proposed demonstrator should comprehensively show how symbiosis and cross-sectorial cooperation can trigger the green transition by sharing resources and infrastructure investments. Regions or cross border area where large industrial clusters are already implemented should preferably be targeted if they can achieve high impact.

Proposals should address the following aspects:

* + - Develop systemic solutions leading to a Hub for Circularity (H4C);
    - (Co-)design and adapt existing processes to integrate new solutions (energy and mass flow coupling, infrastructure, and logistics) and exploit new synergies between sectors;
    - Use digital modelling tools and sensing systems as basis for dynamic resource management, including information on quantities and characterization of material, component and product streams in view of full integrated LCA;
* Establish IT infrastructures and tools that provide a secure basis for the integrated management and the preservation of confidentiality of sensitive data;
*  Deploy one Industrial(-Urban) symbiosis near commercial scale demonstrator using renewables as energy sources and green hydrogen as energy carrier to achieve at least 30% CO2 reduction at regional/area level when deployed at full scale. Balancing the overall energy consumption with efficiency gains for the region/area of at least 10%, including utilization through cascading heat recovery, smart grid, and digital power plants. Optional: in addition, apply or enlarge the use of CCUS (Carbon Capture Utilization and Storage) to the existing local industries; the sustainability gains in energy use should be detailed;
* Use established reporting methodologies for the assessment of industrial symbiosis activities and exchanges, including Symbiosis Readiness Levels, SRLs, best practices established by the European Community of Practice; in addition, connect to the H4C European Community of Practice (ECoP) for best practice and knowledge exchange;
* Include a plan to extend the hub to additional players and multiply the local/regional synergies in the co-implementation of the identified innovations and solutions;
* Simulate replication of similar deployment in two other sites in Europe.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. The exploitation plans should include preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan) indicating the possible funding sources to be potentially used (e.g. Innovation Fund, InvestEU, ESIF).

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal. Interoperability for data sharing should be addressed.

Clustering and cooperation with other selected projects under this cross-cutting topic and other relevant topics in Horizon Europe, with European initiatives (as for example, Circular Cities and Regions Initiative (CCRI) and European Circular Economy Stakeholder Panel (ECESP)), as well as building on existing projects is strongly encouraged (see also Industrial Symbiosis Report from March 2020).

This topic aims to support the goals of the smart cities and climate adaptation missions by contributing to a decrease of harmful industrial emissions while favouring renewable energy sources.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2023-TWIN-TRANSITION-01-38: Hubs for circularity for industrialised urban peripheral areas (Processes4Planet partnership) (IA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 15 and 20 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 40 million. |
| Type of Action | Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 7 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected outcomes: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by demonstrating hubs for circularity (H4Cs) concepts[[12]](#footnote-13), fostering circularity within and beyond process industries and driving the partnership’s innovation portfolio towards “First of a kind” demonstrators to de-risk investment for subsequent roll-out. (P4Planet operational objectives 8 and 9).

Projects are expected to contribute to the following outcomes:

* Demonstrate zero urban waste in a semi-industrial environment through systemic resource recovery as alternative material feedstock; an additional reduction of GHG emissions reduction is expected by explicitly addressing the reduced flow of goods (due to geographical proximity);
* Reduce by 50% freshwater consumption of the area and re-use 90% of the solid waste generated by the water treatment;
* Set up a network of hub partners including local/regional authorities/communities, waste associations, new market entries and other relevant stakeholders;
* Implement a social innovation spin-off action[[13]](#footnote-14) involving one of the local community actors and additional actions to facilitate relations and to involve the local community actors e.g. exchanging knowledge and human capital with the educational establishments and developing flexible learning resources;
* Citizens living in cities will benefit from a healthier environment through industrial/urban symbiosis by lowering emissions through circular and renewable energy sources and waste reduction.

Scope: Urban areas with high volumes of waste (household and end of life consumer waste) should closely interact with adjacent industries to jointly minimize CO2 footprint of industrial production. Improving urban waste management by deploying optimal waste separation, smart recycling technologies, (pre-) treatment solutions and logistics, thus contributing together to the valorisation of secondary materials and overall circularity. The hubs for circularity (H4C) concept is a pathway to exploit local synergies to deploy innovative solutions engaging regional resource management actors in strategic nodes where novel value chains valorising a significant part of end-of-life wastes could connect within and across regions.

The concept of Industrial-Urban Symbiosis (I-US) should be demonstrated at semi industrial scale, by systemically re-integrating the flow of urban wastes in process industries and where applicable downstream in manufacturing and construction. Full attention should be paid on upcycling of secondary materials or products instead of downcycling.

Proposals are expected to address:

* A systemic solution for a H4C including technological and non-technological as well as regional and interregional aspects: closing circularity loops for mixed/combined materials streams based on upcycling and process-based approach to a range of recycling solutions including conversion and downstream, complex multi-material streams, valorisation of waste streams (urban mining);
* Management and processing of secondary resource streams through e.g., collection, disassembly, sorting, purification, concentration, recycling ( for the including but not limited to chemical, metallurgical, or bio-based resources), logistics and trading for their valorisation for the use as feedstock for other plants and companies across sectors and/or across value chains. Connections with manufacturing industries are expected.Proposals can address either materials, water and/or energy, or a combination of those. The remaining non-recyclable fractions will be used to optimal energy recovery. Digital modelling tools, including material passport and information on material streams, as basis for resource management towards fully integrated LCA and Material Flow Analysis MFA (on diverse levels) and for creating transparency and matchmaking opportunities across hubs. Prepare for tagging/matrix for complex consumer products and innovative approach to end-of life materials;
* Explore and detail at least 3 replication scenarios in similar areas in EU creating a coherent portfolio of H4Cs initiatives;
* Include local and regional authorities in an active collaboration to create favourable and coherent place-based framework conditions;
* Favour participative management with the local community and study the evolution of the social impact of the hub, whilst also considering gender perspective and inclusiveness.;
* Identify regulatory barriers and suggest adaptations of regulation;
* Connect to the H4C Community of Practice for best practice and knowledge exchange.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination The exploitation plans should include preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan) indicating the possible funding sources to be potentially used (e.g. Innovation Fund, InvestEU, ESIF).

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal. Interoperability for data sharing should be addressed.

Clustering and cooperation with other selected projects under this topic and other relevant topics in Horizon Europe, with European initiatives (as for example: Circular Cities and Regions Initiative (CCRI) and European Circular Economy Stakeholder Panel (ECESP)), as well as building on existing projects is strongly encouraged (see also Industrial Symbiosis Report from March 2020).

This topic aims to support the goals of the smart cities mission by contributing to a healthier urban industrial symbiosis through waste reduction.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2023-TWIN-TRANSITION-01-40: Sustainable and efficient industrial water consumption: through energy and solute recovery (Processes4Planet partnership) (RIA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 10 and 12 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 30 million. |
| Type of Action | Research and Innovation Actions |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected outcomes: Projects outcomes will enable achieving the objectives of Processes4Planet partnership by designing industrial processes for the maximum resource (water) efficiency and developing new process to ensure full valorisation of process industries wastewater, recycled water, energy, and solute recovery (P4Planet operational objectives 5 and 7).

Projects are expected to contribute to the following outcomes:

* Demonstrate sustainable water consumption based on new technologies for energy and solute recovery;
* Reduce process industry dependency and utilisation of fresh water by at least 20%;
* Prove the economic viability of the processes and technologies for water treatment and recycling particularly when combined with energy and waste reduction strategies;
* Maximise the recovery of substances and energy present in the waste water streams;
* Enable full circular use of water in process industry;
* Demonstrate contribution to EU climate neutrality goals.

Scope: Wastewater discharge from industry has decreased over decades. This is caused by increased regulation (e.g., Industrial Emissions Directive, IED; the European Pollutant Release and Transfer Register, E-PRTR), improvements in treatment and the implementation of best available techniques. Industries that still have high direct releases to water include pulp and paper, steel, energy supply and chemicals among others (Ref. EEA Report 2021). Objective of Processes4Planet in 2030 is to get to 90% of process industry wastewater reused. A breakthrough in wastewater reduction could be envisaged, by combining existing technologies and novel water treatment technologies and reuse with process intensification, energy recovery and excess heat use, e.g., integrated processes with separation systems will reduce water and energy consumption and the amount of final industrial waste water produced. In addition, industrial waste waters often contain signiﬁcant amounts of valuable solutes (e.g. organic matter, salts, phosphates, etc.) which are not optimally valorised.

The proposals should:

* Combine existing and novel water treatment technologies and re-use with process intensification;
* Use in combination smart monitoring technologies including affordable long lasting and reliable sensors and AI driven devices, integrated system risk management models and decision support tools and technologies for water re-use in process industries;
* Seek to integrate advanced Industry 4.0 tools for the optimisation of their process, such as Digital twins;
* Propose new technologies for recovering valuable solutes present in wastewater (metals, organic compounds, etc.) and for eliminating hazardous substances (e.g., micro and nano particles, toxic substances).

In order to maximize impact, technologies in the proposals should not be focused on one sector, but the proposed solution should be applicable in different types of industries; elements related to the replicability and scalability of the technology should be provided. Proposals are encouraged to take into account outcomes from the H2020 CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry.

In addition, the topic could explore synergies with the Mission Oceans and Soil.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. Proposals are encouraged to consider the use of their expected outcomes in a wider approach that might benefit the establishment of Hubs for Circularity.

International cooperation can be considered specially with countries advanced in the field that could bring mutual benefit from different perspectives.

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2024-TWIN-TRANSITION-01-41: Breakthroughs to improve process industry resource efficiency (Processes4Planet partnership) (RIA)

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 10 and 12 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 30 million. |
| Type of Action | Research and Innovation Actions |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G. |

Expected outcomes: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by designing processes for maximum resource efficiency (related to P4Planet operational objective 5).

Projects are expected to contribute to several of the following outcomes:

* Achieve a step change in the process industry’s green transformation by improving by at least 30 % the industrial processes resource[[14]](#footnote-15) efficiency compared to the state of the art;
* Prove the techno-economic feasibility of novel technologies and processes, demonstrated and validated at suitable scale against current industrial processes to produce the same products;
* Overall positive environmental and if relevant health and safety impact demonstrated;
* Increase the competitiveness and resilience of the European process industry;

Scope: Process industries will greatly benefit from radically new approaches that will lead to a much higher resource efficiency (including higher selectivity), producing less low-value by-products and waste and enabling to cope with higher variability of feedstock. To reach ambitious targets regarding resource efficiency, disruptive process technologies must be developed in addition to process efficiency options for existing technologies.

Proposals should:

* Develop disruptive process technologies to improve resource efficiency, such those based on: process intensification (e.g., 3D printed processes equipment, coupling of process steps, new processes that integrate multiple reaction steps, activation of molecules using renewable energy via alternative processes e.g. microwave, plasma); or preventing and minimising waste generation by, e.g. processes that adjust in real time to changes or develop tighter processing controls develop solutions to ensure higher yields from complex and fluctuating raw material feeds;
* Where relevant advanced process technologies and their combinations need to be developed and supported by advanced materials innovation and the implementation of enabling digital technologies including advanced concepts on process control and data driven Artificial Intelligence.

The proposals should include energy efficiency, techno-economic and life-cycle assessments considering the overall process.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

All proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes

This topic implements the co-programmed European partnership Processes4Planet.

HORIZON-CL4-2023-TWIN-TRANSITION-01-42: Circular economy in process industries: Upcycling large volumes of secondary resources (Processes4Planet partnership) (RIA)

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| **Specific conditions** | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 10 and 12 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 30 million. |
| Type of Action | Research and Innovation Actions |
| Technology Readiness Level | Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G.  Lump sum |

Expected outcomes: Projects outcomes will enable the achievement of the operational objectives of Processes4Planet partnership by developing new processes for circularity of secondary materials from wastes/residues for all industrial processes (related to P4Planet operational objective 6).

Projects are expected to contribute to the following outcomes:

 Prove the technical and economic feasibility of the use of secondary resources in the process industry leading to products with identical properties and performances than those produced using primary resources and allowing production without quality restriction;

* Increase the use of secondary resources in the process industry driving to significant increase in resource efficiency across the value chain and subsequent reduction on CO2 emissions; reduction of waste sent to landfill and overall positive environmental impact;
* Increase the competitiveness of the European process industry; new business opportunities and revenue flows for recycling companies, benefiting particularly SMEs, which dominate this sector of the market;
* Foster data sharing, and FAIR (Findability, Accessibility, Interoperability and Reusability) of digital assets principles, considering the application of digital product passport between recycling companies and the process industry to improve the economy of scale in upcycling of material streams;
* Increase the use of unused and new skills to unfold the potential of the technological solutions at the workplace for upcycling and contribution to inclusive growth;
* At a longer term, to pave the way toward sustainable-by-design for circular products.

Scope: Currently only 12% of the material resources used in the European process industry are recycled and recovered materials and these are mostly downcycled to less valuable products. To move towards a truly circular and sustainable process industry that uses its resources consciously, and without landfilling, breakthrough innovations aiming at upcycling large amounts of secondary resources are needed. The focus of this topic is the upcycling of secondary resources that must lead to the same quality and diversity of products as those obtained when using primary resources. The innovation needed will depend on the addressed waste category. However, even if the upcycling technologies may be sector specific, the cross-sectorial elements are important and should deserve due attention.

Proposals are expected to address:

* Considering the upgrading of secondary resources, when relevant, which may include the development of better separation and sorting technologies and digitalisation;
* Ensure consistent quality and safety of recyclates and their suitability for the upcycling process itself;
* If relevant, detect and remove additives in the secondary resources stream;
* The innovative upcycling of the secondary raw materials should be demonstrated through at least two realistic use cases that must lead to the same quality and diversity of products as those obtained when using primary resources, with demonstrable economic return, developed in closed cooperation between recyclers, process industry, users and technology providers;
* Successful upcycling relies on advanced monitoring and sensing in the process industries and value chains, and on an improved data completeness, accuracy and interoperability between the process and the recycling companies. Upcycling may create new business opportunities and models. These are aspects that should be duly considered.

Proposals should include energy efficiency techno-economic and life-cycle assessment considerations of the overall process.

Proposals should actively pursue the involvement of all the actors in the value chain from the process industry to formulators, recyclers, public authorities and standardisation actors.

Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Additionally, a strategy for skills development should be presented, associating social partners where relevant.

All proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and are encouraged to consider the use of their expected outcomes in a wider approach that might benefit the establishment of Hubs for Circularity.

International cooperation can be considered specially with countries advanced in the field that could bring mutual benefit from different perspectives.

The proposals under this topic may cover any of the process industries sectors and related end of life wastes sectors (with the exception of plastic wastes which were the object of the WP 2021-22[[15]](#footnote-16) and steel scrap part of Clean Steel partnership which are excluded).

This topic implements the co-programmed European partnership Processes4Planet.

Clean Steel

HORIZON-CL4-2023-TWIN-TRANSITION-01-43: Low carbon-dioxide emission technologies for melting iron-bearing feed materials OR smart carbon usage and improved energy & resource efficiency via process integration (Clean Steel Partnership) (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 4 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 23 million. |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The funding rate is up to 60% of the eligible costs. This funding rate applies both to members and non-members of the partnership, except for non-profit legal entities, where the funding rate is up to 100% of the total eligible costs. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  To ensure a balanced portfolio covering the two technology areas in the scope below, grants will be awarded to applications not only in order of ranking, but also to at least one project in each technology area, provided that the applications attain all thresholds. |

Expected Outcome: Projects outcomes will enable achieving the objectives of Clean Steel Partnership (CSP) by contributing to the following two aspects: 1) integrating the next-generation iron-bearing feed materials melting technologies into an existing and optimised steelwork, to further push the transformation towards a low-CO2 production site (related to CSP Building Block 3: Melting of pre-reduced and reduced ore, scrap, and iron-rich low-value residues for clean steel production[[16]](#footnote-17)). 2) curtailing CO2 emissions generated by the steel industry by smart carbon usage - process integration (SCU-PI), which allows reducing fossil fuel (e.g., coal) used in blast furnace - basic oxygen furnace (BF-BOF), electric arc furnace (EAF) and direct reduction - EAF (DR-EAF); this includes, among others, the (partial) replacement of coal by e.g., natural gas, biogas, or hydrogen, or the advanced management of the energy streams and process gases (e.g., off gases released from EAF/BF-BOF; relevant relations to CSP Building Block (BB) 1 “Gas injection technologies for clean steel production”; BB 4 “Adjustment of today’s production to prepare for the transition towards climate neutrality”; BB 7 “Heat generation for clean steel processes”, and BB 10 “Enablers e.g., skills, digitisation, for clean steel development”).

Projects are expected to contribute to one or more of the following outcomes:

* Innovative or improved melting processes for next-generation clean steel production, such as, but not limited to, charging and pre-heating technologies for iron-bearing feedstock to reduce the CO2 emission by at least 20 % compared to current state of the art;
* Integration of next generation melting technologies into an existing and optimised steelwork, with the objective to enable transformation towards a low-CO2 production sites. Proposed solutions should consider also the supply chain to strongly reduce the environmental footprint of the steel melting process;
* Enhance the use of iron-bearing feedstock intermediate products with variable content of carbon and variable metallisation, including low-value iron-based sources. (e.g., DRI, recovered by-products) in melting processes.

OR

To one or more of the following outcomes:

* Use advanced information and communication technology (ICT) to achieve process and energy integration and optimisation of the efficiency of steelmaking and downstream processing (heating and treatment furnaces) in steel plants;
* Improve the injection of metallurgical gases, as well as hydrogen-rich gases (e.g., a mixture of hydrogen and methane) and/or hydrogen, within the steel making processes;
* Adaptation of gas handling systems to new gases and their related properties;
* Utilisation and recycling of gases (e.g., carbon-containing process gases, oxygen, external gases, such as but not limited to, waste gases from a neighbouring chemical plant or syngas produced from an external pyrolysis plant) in integrated plants with mixed technology routes;
* Enhance production and energy management of integrated plants with mixed technology routes (e.g. blast furnace–basic oxygen furnace (BF-BOF), direct reduction-electric arc furnace (DR-EAF)), to drastically reduce the consumption of coal and CO2 emissions.

Scope: Proposals should aim at one of the following two aspects, corresponding respectively to the points 1) and 2) outlined under the expected outcomes section:

1. Proposals should address novel and adapted low-CO2 emission technologies for pre-treatment, pre-heating, and melting of iron-bearing feedstock materials with variable content of carbon and variable metallisation including, among others, low-value iron-based sources (i.e., >5% of acidic gangue), or dust and sludge from de-dusting systems. The focus is on the three technological routes of blast furnace–basic oxygen furnace (BF-BOF), electric arc furnace (EAF), and direct reduced iron/ hot briquetted iron form (DRI/HBI) including the refining and casting processes.

Multidisciplinary research activities should address one or more of the following:

* Adding variable percentages of steel scrap and/or a wide range of iron-bearing feed materials with variable content of carbon and variable metallisation to the melting process, including low-value iron-based sources (i.e., >5% of acidic gangue and/or residue) without prejudice to the yield of the metallic charge;
* Adaptations on existing melting processes to replace the traditional use of carbon and hydrocarbons (e.g., for re-carburisation of the liquid, for promoting slag foaming or charge heating) with climate-neutral sources and/or hydrogen;
* Reduction of the specific consumption of the melting step to achieve a low carbon process by optimisation of energy inputs (electrical vs. chemical) depending on the charge mix (scrap, DRI, HBI, pig iron, low-value iron-based sources) and/or by pre-heating of the iron-bearing feed materials;
* Handle a variability of iron-bearing feedstock in the melting process by methods to assess the material quality within production chains, to recover metal contents from low-value iron-ore feedstock or residues by pre-reduction or reduction smelting with H2, biogas, CO2-lean electricity, and carbon-bearing residues;
* Controlling of tramp elements in molten liquid obtained by low iron-bearing feedstock to ensure quality and castability of melted steel and improvement of yield and quality of process and product;
* New sensors and tools for real-time management inside the melting process such as liquid metal and slag temperature and composition and/or reliable energy forecasting to optimal setup and process control.

OR

1. Proposals should aim at the reduction of fossil fuel and reductant used in both BF-BOF and EAF/DR-EAF steel production and, in turn, curtailing CO2 emissions, using process technologies for gas injection e.g., for BFs, DR plants, but also for EAFs. New control techniques will also have to be developed considering process needs, safety issues, and economic aspects. Gas injection options have the potential for very low CO2 emissions but need intermediate steps before being ready for full industrial deployment (e.g., injection of high percentages of hydrogen in BF and EAF). To achieve the objectives, it could be relevant to consider technology improvement along with developing appropriate business models.

Multidisciplinary research activities should address one or more of the following:

* Process integration through injection of metallurgical gases as well as natural gas or biogas or O2 and H2 (H2-rich gases or pure H2) into metallurgical reactors e.g., BF, DR, or EAF to minimise the need for fossil carbon including new developments regarding the related process technology and control technology;
* Utilisation and recycling of gases as substitutes in existing steel processes such as, but not limited to, coking plant, sinter plant, BF, DR, BOF, EAF;
* Consider techniques and tools, which support the immediate decrease of the carbon footprint on the industrial level with measures, such as but not limited to involve the production cycle, the energy, and materials supplied;
* Adapt gas handling and distribution to new gas properties and amounts and consider process needs, safety issues, and economic aspects;
* Integrate new measuring technologies and/or digital tools for monitoring and control inside the novel architectures of ICT covering the processes considered (existing and new processes), conditions and resources; the extensive use of Industrial Internet of Things (IoT) approaches should allow the easy and fast integration of the new measurement techniques into the set of data streams to be monitored and offline / online used for process setup and control and knowledge extraction;
* Provide concepts addressing the re-optimisation of the process integration in future integrated steelworks based on clean steel production technologies and considering the stepwise transition of production lines from current conventional iron and steelmaking to future low carbon technologies including relevant intermediate states with mixed production chains.

This topic implements the co-programmed European Partnership on Clean Steel.

HORIZON-CL4-2024-TWIN-TRANSITION-01-44: Digital transformation and ensuring a better use of industrial data, which can optimise steel supply chains (Clean Steel Partnership) (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 10 million. |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  Lump sum.  The funding rate is up to 60% of the eligible costs. This funding rate applies both to members and non-members of the partnership, except for non-profit legal entities, where the funding rate is up to 100% of the total eligible costs. |

As mentioned in the Clean Steel Partnership (CSP) Strategic Research and Innovation Agenda (SRIA)[[17]](#footnote-18), digitalisation and social aspects are both addressed in the Building Block 10 because of their strong role of enabling the carbon neutral transition. In particular, digitalisation enables all the other Building Blocks, as evidenced in Table 12 of the CSP SRIA. So, the optimal deployment of digitalization implementing the integrated approach along the steel value chain must be provided according to outcomes and scopes defined below.

Expected Outcome: Projects are expected to contribute to one or more of the following outcomes:

* Increasing awareness and effectivity leading to total safety of steel manufacturing processes and CO2 reduction through digital transition with better use of industrial data;
* Extension of inline and real-time tools to monitor and control sustainability of the running process conditions, to set up countermeasures to stay into the optimal process window; this includes, but is not limited to, energy and (intermediate) product quality forecasting, online comparison between forecast and realisation, control of metal slag;
* Enhancement of the in-line classification of feedstock and intermediate products through the continuous analysis of composition and bulk properties by applying holistic soft sensor approaches considering the assembly of sensors, specific models, and advanced data processing according to SRIA (specifically see page 41, 42 of the SRIA);
* Increasing effective and secure data sharing in steel plants to realise the seamless digital integration of the value chain and the interoperability of systems and tools by implementation of existing and enhanced standardised protocols;
* Novel sensors and models for real-time process control (see page 41, 42 of the SRIA), such as, but not limited to, metal slag parameters (e.g., composition) and temperature measurement, slag analysis, off-gas analysis, energy forecasting to match demand and offered mix in the power grid considering energy generated from renewable sources; the latter could require cooperation between steel experts and electric power players in the market. The expected outcome is an enhanced merging of planning activities and approaches to run plant processes.

Multidisciplinary research activities should address one or more of the following topics:

* Novel sensors, soft sensors and related models and approaches to reduce the carbon footprint by merging the use of sensors and data processing capabilities for huge volumes of heterogeneous data streams; systems/tools enabling the transition from legacy into new architectures capable to supply data in a seamless way “when, where and what” including the development and testing of implementation guidelines. This should enable the traceability of materials and process information throughout the value chain to promote improved product quality, efficiency and integrated process control and management (including multi-scale modelling of structure, and structure vs. properties correlations);
* Statistics coupled with outstanding analytical capabilities to improve data quality and to help steel plant operators to increase the process yield and to improve the quality of intermediates and final steel products, while addressing the best approach to limit carbon emissions;
* The application of combinations of advanced digital technologies, such as but not limited to model based, knowledge based and data based methods, artificial intelligence (AI), supercomputing, edge computing, cloud systems and internet of things (IoT) to develop decision-supported planning and process monitoring tools for clean steel manufacturing operable in offline or online modes;
* Involvement of operators and process experts in the design and development phases of digital technology integration, ensuring the uptake of human experiences and a user-friendly processing of results for easier industrial integration (see Table 12 row 3 of the CSP SRIA[[18]](#footnote-19)). This may also include issues of skilling and standardisation and man-machine interaction by deploying Virtual and Augmented Reality techniques.

This topic implements the co-programmed European Partnership on Clean Steel.

HORIZON-CL4-2023-TWIN-TRANSITION-01-45: Circular economy solutions for the valorisation of low-quality scrap streams, materials recirculation with high recycling rate, and residue valorisation for long term goal towards zero waste (Clean Steel Partnership) (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 12 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 4 and achieve TRL 5-6 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcome: Projects are expected to contribute to one or more of the following outcomes:

* Implementation of highly efficient technologies for recovering metal (iron and non-ferrous metals) and mineral fractions from in-plant steelmaking residues. The recovery technology should condition the composition and properties of the residue such as, but not limited to, slag, sludge, scale, filter dust, sinter waste produced by blast furnace/basic oxygen furnace (BF/BOF) and electric arc furnace (EAF) routes, but also by next-generation iron and steelmaking such as, but not limited to the direct reduction/ electric arc furnace (DR/EAF) pathway including the melting and reduction of low-grade iron ore. Two possible ways are envisioned, whereas the first one is based on cooling and mechanical steps, such as, but not limited to, wet or dry granulation followed by phase separation; the second one relies on dedicated processes to enable a direct recycling of residues in existing production processes or in standalone pyro-metallurgic melting and reduction or biohydrometallurgical units. Such knowledge and results should support the valorisation of the residues in the present value chain and/or in innovative applications. If appropriate, residues could be chemically and structurally characterised at micro-scale level via characterisation (also multi-modal) performed at analytical research infrastructures, which would allow obtaining relevant statistical information;
* Describe and/or modify the composition and properties of residues such as, but not limited to, slags and/or sludge produced by next-generation steelmaking such as, but not limited to the DR/EAF pathway. Such knowledge and results should support the valorisation of the residues in the present value chain and/or in innovative applications. If appropriate, residues could be chemically and structurally characterised at micro-scale level via characterisation (also multi-modal) performed at analytical research infrastructures, which would allow obtaining relevant statistical information;
* Enhanced utilisation of low-quality scrap by new technologies and by new iron/steel making routes (such as smart BF-BOF routes to be line with decarbonisation targets), targeting high quality of the finished product and reduced CO2 emissions. The aim is to remove scrap impurities (tramp elements) such as, but not limited to, copper before melting, for example through scrap yard management and charge preparation for quality upgrading, or after the melting in liquid phase, through, but not limited to, metallurgical methods;
* Technologies to broaden the types of ore grades utilized in different processes. The aim is to establish processes that allow for upgrade of low-grade iron ores and other iron-bearing materials to make them suitable for, but not limited to, cold bonded agglomeration, pelletisation, or direct use in existing steelworks.

Scope: In the medium-term scenario, new technologies will enter in the iron and steelmaking production process, e.g., higher amount of scrap in basic oxygen furnaces (BOF), more electric arc furnace (EAF) based steelmaking, as well as more directly reduced production capacity are foreseen. Therefore, it is necessary to consider the influence of the feedstock quality, of the new production technologies and of the composition of the by-products generated on the present model of circular economy for both, economic, and environmental aspects.

Recycling of steel scrap, no matter if it is home-scrap, industrial scrap, or post-consumer scrap, and, by consequence, the increased consumption of scrap, the recovery of iron from residues, and the use of low-quality iron ore materials, are vital to diminish the need for additional primary resource extraction and hence to decrease the environmental impact of steel manufacturing. This is also contributing to a wise and sustainable management approach of iron resources. Applying circular economic principles to product design (thus, designing for remanufacture and recycling) will allow ferrous and valuable non-ferrous metals, such as copper, to be more easily separated and recycled.

Proposals should consider higher utilisation of low-quality iron-bearing materials, in particular, but not limited to low-quality scrap, with higher amounts of unwanted elements (residual and alloying elements, such as Cu, Sn, Sb, As and Bi, but also Cr, Mo, B), that prevent the production of many steel grades, and a higher utilisation of internal residues, and the recycling of its metal contents. Where appropriate for the study proposed, analytical research infrastructures, such as synchrotron facilities, should be considered as capable of providing large amount of statistically relevant data. The aim is to obtain a sustainable vision of reduced virgin raw materials use.

Moreover, the existing recycling and reuse solutions for today’s steel industry will be affected and new solutions need to be developed to maintain a sustainable development of the steel industry in the future. Projects should aim at the selection and integration of best available and applicable technologies supported by digital smart tools. These are key elements to improve and adapt circular economy solutions for the long-term goal towards zero waste increasing the use of scrap, the materials recycling rate and the residue valorisation by targeting to achieve the same quality of the finished product and at the same time reducing CO2 emissions due to lower energy need with respect to iron-ore.

Multidisciplinary research activities should address one or more of the following:

* New technologies for reduce / reuse / recycle of residues and by-products in the next generation iron ore and steelmaking process:
  + Increasing reuse and recycling of steelmaking and foundry slags;
  + Recycling and valorisation of dusts, and sludges;
  + Recovering iron and metal-fractions from in-plant residues;
  + Conditioning processes for the use of residues and low-quality iron ore grades, like agglomeration or pelletisation;
  + Implementing Circular Economy and Industrial Symbiosis for long-term goal towards zero- waste.
* Sustainable and efficient scrap management and recycling aiming high-grade steel production with increased scrap rates including:
  + Improved mechanical scrap preparation coupled with scrap analyses at various levels;
  + Continuous analysis and monitoring of the scrap bulk composition using sensor systems with accompanied model-supported Big Data analytics and Artificial Intelligence (AI) techniques for scrap classification;
  + Scrap yard management and charge preparation for quality upgrading;
  + Optimised and more flexible primary and secondary steelmaking processes considering enhanced scrap rates.

This topic implements the co-programmed European Partnership on Clean Steel.

HORIZON-CL4-2024-TWIN-TRANSITION-01-46: CO2-neutral steel production with hydrogen, secondary carbon carriers and electricity OR innovative steel applications for low CO2 emissions (Clean Steel Partnership) (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 20 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 4 and achieve TRL 5-6 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  To ensure a balanced portfolio covering the two technology areas in the scope below, grants will be awarded to applications not only in order of ranking, but also to at least one project in each technology area, provided that the applications attain all thresholds. |

Expected Outcome: The establishment of a clean steel market will be based upon decarbonisation of the steel making and production through the use of advanced and breakthrough technologies. The modification and change of production routes will have an impact onto the design of customised steel products and its applications in the market.

Projects are expected to contribute to one or more of the following outcomes:

* Introducing the use of secondary carbon sources, including waste and residues of biological origin[[19]](#footnote-20) in steelmaking processes to target improved sustainability and to allow a technically and economically feasible transition to reduce the use of fossil carbon as fuel or reducing agent;
* Combining the reduction of fossil carbon-related emissions obtained with technologies to reduce steelwork energy consumption with improvements in the materials and energy flows;
* Reduction of carbon footprint by incrementally adapting to the use of low-CO2 hydrogen to heat steel for rolling, shaping, and heat treatment, considering also a coupling between hydrogen and/or electrical heating and fuel-flexibility concepts;
* Valorisation of non-conventional ores, e.g., in (photo)electrolysis processes;
* Substitution of fossil sources as carburiser and slag foaming agent by alternative materials in electric arc furnaces (EAF) and contribute to achieve low-CO2 steel production;
* Enhancing the handling of carbon-bearing residues and recovery of metal contents from low-value residues by pre-reduction or reduction smelting with hydrogen and/or electricity;
* Identify and analyse the amount of European existing technologies that could be efficiently retrofitted to CO2 neutral solutions (e.g. H2 DRI). Differentiate between incremental retrofits and retrofits allowing for production of carbon-free iron and steel. The final evaluation should provide a comprehensive overview of technical possibilities along with possible implementation timelines, and indicate on emission reduction stages and required financial investments. Projects awarded under this point will require the participation of at least one higher education establishment or one research organization and will be developed in contact with the European Commission.

OR

To contribute to at least two of the following outcomes, which requires designing steel alloys and products and validating their application for the clean steel market (related to CSP specific objective 6, see also building block Building block 12: Innovative steel applications for low CO2 emissions in SRIA[[20]](#footnote-21)):

* New or modified alloying concepts, downstream processing and manufacturing processes for new clean steel grades, as well as derivation of new test methods that are closer to reality into the industrial application;
* Manufacture steels with improved life cycle contributions to CO2 emissions reduction; this is the case for, but not limited to, the transport sector, which includes improved possibilities for re-use and re-manufacture; this includes also innovative manufacturing technologies for steel grades supporting decarbonisation like, but not limited to, electric strip;
* Clean steel grades with improved in-use properties obtained by controlling the application properties (e.g., yield strength and/or high ductility steels, fatigue, embrittlement, internal and external corrosion and other properties relevant to service life in the application) supported by known or new techniques (e.g., machine learning (ML), metallurgical/ thermodynamic simulations, multi-scale models, defect vs. structure vs. properties correlations, finite element methods (FEM), realistic and applied testing methods) to realise the desired steel grade characteristics;
* Innovative simulation methods and tools (e.g., Calculation of PHAse Diagrams (CALPHAD), crystal plasticity, artificial intelligence (AI), machine learning (ML), realistic and application-oriented testing methods, multi-scale modelling, and microstructure, defects and properties prediction tools, digital twins etc.) to accelerate the development processes of the mentioned clean steel grades and their manufacturing processes;
* Advanced grades of steel for use in efficient high temperature processes including, for instance, thermal reactors for waste recovery;
* Advanced grades of steel for use in the railway's systems of high-speed trains to assure high quality, good weldability, and very high mechanical properties, including high yield strength, metal-to-metal wear resistance, and high rolling contact fatigue resistance;
* High-performance structural steels (e.g., high-strength, high-pressure resistant, creep resistant, oxidation resistant, etc.) not containing critical strategic elements (such as, V, Nb, Ti, etc.) and/or characterized by increased tolerance to the content of contaminants in the scrap, such as for instance Cu;
* Steel grades with increased use of low-quality input materials (e.g., scrap, secondary raw materials, ores/dust, etc.) by new knowledge of the influences on the application properties of manufactured steel products tested under realistic operating conditions, taking into account the entire manufacturing process to identify the acceptance of buyers/users (incl. economic/ecological benefits, questionnaires, market research).

Scope: Proposals should aim at one of the following two aspects:

1. Proposals should relate to metal reduction processes using hydrogen, renewable electricity, and/or secondary carbon carriers, and/or to replace fossil fuels and reductants in steelmaking and in downstream processing in steel plants. Proposals under this topic are expected to:

* Provide concepts addressing the modifications of the existing and new installations for steel production, such as:
  + Blast furnace–basic oxygen furnace (BF-BOF);
  + Electric arc furnace (EAF);
  + Direct reduced iron (DRI) process: In this case, compare the feedstock’s iron content requirements necessary for the direct reduction process in comparison with other alternative processes (e.g., electrolysis);
  + Alternative reduction processes (such as electrolysis on non-conventional ores);
  + Heating and treatment of semi-finished products.
* Such modifications could also concern the internal and external flows of energy and materials to re-use e.g., metallurgical gases (internal re-cycling) and to upgrade them with new sources, e.g., by replacement of fossil carbon, both as reducing agent, and heat sources with hydrogen and alternative carbon sources;
* Consider the integrated preparation (reforming, separation, heating, compression) of external carbon-lean gases or internally recycled CO/CO2 streams for efficient use as reducing agent, but not limited to or for use in heating process.

OR

1. Proposals should address the conception and production of clean steel for use in established markets and/or in markets having specific demanding or harsh environments. Of interest are steels and steel grades capable to demonstrate for instance high level of yield strength, high level of fatigue, high resistance to pressure, heat, wear, cyclic loads, crash and to severe corrosion conditions. The scope also covers the maximisation of low-quality materials usage and their influence on the product quality. Where appropriate for the study proposed, analytical research infrastructures, such as synchrotron facilities, should be considered as capable of providing large amount of statistically relevant data to validate chemistry and structure/morphology. Proposals should demonstrate the CO2 reduction potential by conception along the advanced/breakthrough manufacturing routes and/or by the application of their innovative steel solution.

Research should contribute to pre-standardisation documents and technical reports to support achieving innovative industrial applications of advanced clean steel grades.

Specific budget needs to be allocated in the project for pursuing dissemination and exploitation activities with Clean Steel Partnership (e.g. exchange of information, carbon reduction potential etc.).

This topic implements the co-programmed European Partnership on Clean Steel.

# **Destination: Increased Autonomy in Key Strategic Value Chains for Resilient Industry**

**Industrial leadership and increased autonomy in key strategic value chains with security of supply in raw materials**, achieved through breakthrough technologies in areas of industrial alliances, dynamic industrial innovation ecosystems and advanced solutions for substitution, resource and energy efficiency, effective reuse and recycling and clean primary production of raw materials, including critical raw materials, and leadership in the circular economy.

## **Raw Materials for EU strategic autonomy and successful transition to a climate-neutral and circular economy**

**HORIZON-CL4-2024-RESILIENCE-01-01: Exploration of critical raw materials in deep land deposits (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 20 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 3-5 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |
| *Lump-sums* | **YES** |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Develop innovative technologies for exploration of critical raw materials in deep land deposits in the EU and non-EU countries;

-Increase the resources and reserves of various primary critical raw materials within the EU and non-EU countries;

-Accelerate development of EU domestic critical raw materials exploration projects integrating innovative technologies that can form the basis for new EU SMEs and junior exploration companies.

-Strengthen EU autonomy and ethical sourcing of raw materials by developing socially and environmentally acceptable means of discovery of primary raw materials.

-Improve responsible supply of raw materials to the EU in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[21]](#footnote-22)

-Promote the utilisation of UNFC (United Nations Framework Classification for Resources) and UNRMS (United Nations Resource Management System) in the raw materials sector.

Actions are expected to contribute to the implementation of the EU action plan on Critical Raw Materials.[[22]](#footnote-23)

Scope:

Actions should map Europe’s primary raw materials potential and raw materials production, using geoscientific approaches and refining capacities in a harmonised form, using UNFC (United Nations Framework Classification for Resources) and UNRMS (United Nations Resource Management System).

-Develop and deploy new or improved highly efficient, sustainable exploration technologies, such as UAV assisted geological exploration in remote areas, geophysics, 3D modelling, new drilling techniques, high resolution laboratory techniques, artificial intelligence and data processing to identify deep seated mineral deposits of critical raw materials.

Actions should also contribute to improving the awareness of the general public across the EU about:

-The importance of raw materials for a successful transition to a climate-neutral and digitised economy and society; and

-The ensuing need for a secure, sustainable, and responsibly-sourced supply of raw materials, including from domestic sources to strengthen EU open strategic autonomy and reduce over-dependence on third countries.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2023-RESILIENCE-01-02: Innovative technologies for sustainable and decarbonised extraction (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 25 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 3-5 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |
| *Lump-sums* | **YES** |

Expected Outcome:

A secure supply of sustainable raw materials is crucial for the green and digital transition. Environmentally friendly, safe, intelligent and resource efficient extraction technologies and methods for both open pit and underground mining need to be developed and implemented.

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

Develop innovative technologies for extraction of raw materials in the Europe .-Increase the domestic EU sourcing of raw materials.

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[23]](#footnote-24)

-Promote the utilisation of UNFC (United Nations Framework Classification for Resources) and UNRMS (United Nations Resource Management System) in the raw materials sector.

-Accelerate development of EU domestic raw materials exploration projects integrating innovative.

[[24]](#footnote-25)Scope:

Actions should develop new sustainable concepts and technological solutions, including alternative approaches, for mining of complex or difficult to access mineral deposits, including mining wastes and abandoned mining sites, particularly addressing the challenges of accessibility, industrial viability, safety and environmental impacts, including wat use.

Actions should be driven by industry and raw materials users. The actions should justify the relevance of targeted minerals and metals. Priority are the EU critical raw materials[[25]](#footnote-26). Sea mining is excluded from this topic.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2023-RESILIENCE-01-03: Technologies for processing and refining of critical raw materials (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 7.3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 22 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Increase recovery rates of valuable raw materials, particularly critical raw materials from low grade or complex res and/or from extractive waste;

-Significantly increase economic performance in terms of higher material-, water-, energy- and cost-efficiency and flexibility in minerals processing and metallurgical processes;

-Significantly improve the health, safety and environmental performance of the operations throughout the whole life cycle which is considered, including a reduction in waste, wastewater and emissions generation and a better recovery of resources from generated waste;

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[26]](#footnote-27)

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[[27]](#footnote-28)

Scope:

Actions should demonstrate new or improved systems integrating relevant processing and refining technologies for better recovery of raw materials from low grade and/or complex ores from extractive wastes, less waste, higher energy efficiency. The action could also reduce the content of toxic elements or compounds in the resulting material products. The actions should target minerals and metals, particularly Critical Raw Materials[[28]](#footnote-29).

The solution proposed should be flexible enough to adapt to different or variable primary and secondary raw materials grades and should be supported by efficient and robust process control. Where relevant, any solution proposed for the reduction of the content of toxic elements or compounds in the resulting materials should also include the appropriate management of the hazardous substances removed.

Actions should develop intelligent and innovative production systems which better utilise natural resources by minimising losses during waste-rock separation in an optimised and energy-efficient process and by minimising use of water.

Recycling of end-of-life products is excluded from this topic.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2024-RESILIENCE-01-04: Technologies for processing and refining of critical raw materials (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 7.3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 22 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Increase recovery rates of valuable raw materials, particularly critical raw materials from low grade or complex ores and/or from extractive waste;

-Significantly increase economic performance in terms of higher material-, water-, energy- and cost-efficiency and flexibility in minerals processing and metallurgical processes;

-Significantly improve the health, safety and environmental performance of the operations throughout the whole life cycle which is considered, including a reduction in waste, wastewater and emissions generation and a better recovery of resources from generated waste;

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[29]](#footnote-30)Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[[30]](#footnote-31)

Scope:

Actions should demonstrate new or improved systems integrating relevant processing and refining technologies for better recovery of raw materials from low grade and/or complex ores from extractive wastes, less waste, higher energy efficiency. The action could also reduce the content of toxic elements or compounds in the resulting material products. The actions should target minerals and metals, particularly Critical Raw Materials[[31]](#footnote-32).

The solution proposed should be flexible enough to adapt to different or variable primary and secondary raw materials grades ~~ore/secondary raw material grades~~ and should be supported by efficient and robust process control. Where relevant, any solution proposed for the reduction of the content of toxic elements or compounds in the resulting materials should also include the appropriate management of the hazardous substances removed.

Actions should develop intelligent and innovative production systems which better utilise natural resources by minimising losses during waste-rock separation in an optimised and energy-efficient process and by minimising use of water

Recycling of end-of-life products is excluded from this topic.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2023-RESILIENCE-01-05: Recycling technologies for critical raw materials from EoL products (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 28 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors which will alleviate critical raw materials dependency. Projects are expected to contribute to the following outcomes:

-Develop raw materials recycling and re-use of components and/or products from end-of-life products technologies and urban mines, including efficient sorting technologies for separation and recycling and the sustainable embedment of the process regarding energy, resource and water efficiency

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[32]](#footnote-33)

Materials.[[33]](#footnote-34)Scope:

Actions should develop material efficient high-quality recycling and preparation for re-use of one or more of the following end-of-life product categories/key waste streams: waste electrical and electronic equipment (WEEE), end-of-life vehicles[[34]](#footnote-35), waste windmills[[35]](#footnote-36) and solar PV and machine tools (e.g. hard metal scrap). Only critical raw materials will be considered eligible for the actions. Rare earths permanent magnets are excluded from this topic since they are subject to a dedicated call HORIZON-CL4-2023/2024-RESILIENCE-01-08: Recyclability and resource efficiency of Rare Earth based magnets

.

Their processing, reuse, recycling and recovery schemes are complex and imply different steps, ranging from collection, logistics, sorting and separation to cleaning, refining and purification of materials.

Actions should focus on the whole chain of recycling processes and procedures - from collection, logistics, charecterisation, sorting, cleaning, refining and purification of secondary raw materials and quality of produced outputs.

Recycling and re-use where the recycled material is of lower quality and functionality than the original material (downcycling), is not in the scope of the topic.

Actions should acquire new data on secondary raw materials via in situ sampling from different regions across the EU, collect existing data and present in a harmonised UNFC format (United Nations Framework Classification for Resources) and develop sampling protocols, methodologies, and technologies to quantify and characterise the CRM resources in specific products, urban mines and waste repositories.

Actions should envisage clustering activities with other projects aiming at second life, re-use, repurposing, remanufacturing of products and/or components relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2023-RESILIENCE-01-06: Earth Observation platform for raw materials (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 6.7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 20 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

- Develop and deploy innovative technologies, products and services based on satellite, airborne and ground based remote sensing data combined with other in-situ data sources (e.g. geophysical and geological data), supporting the whole raw materials value chain, from mineral exploration to post-closure activities;

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[36]](#footnote-37)

Improve knowledge on raw materials resources in Europe.

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[[37]](#footnote-38)

-Develop best practices and standards for innovate EO technologies, products and

Scope:

Actions should develop an Earth Observation platform for raw materials similar to ESA exploitation platforms, and create a sustainable business model that can facilitate access to developed Earth Observation technologies, products and services to the mining industry and public stakeholders.

The Earth Observation platform for Raw Materials should support the implementation of the EU’s international strategic partnerships with resource rich countries (e.g. Canada, Ukraine, Serbia, Africa or Latin America).

ctions should increase the uptake of the Earth Observation technologies to deliver a responsible and sustainable mining industry, including mining of secondary deposits (e.g. old mine tailings).

Actions should deliver on-line processing tools, services and products to generate value-added raw materials information products, pre-processed optical and radar data from the Sentinel satellites of the EU Copernicus programme, as well as access to data and services from other high-resolution satellites, airborne, ground based and in situ data.

Actions should improve mineral exploration at regional scale and target definition at local scale, exploiting multi- and hyperspectral satellite, airborne and ground based sensors and relevant subsurface data.

Actions should monitor the volume and rate of extraction of materials in opencast mining based on airborne and satellite very high-resolution imagery

Actions should map and monitor secondary raw materials in the Europe based on high-resolution CORINE and hotspot-based VHR land cover products;

Actions should monitor ground stability in active and/or abandoned mining areas in Europe, exploiting the Ground Monitoring Service of Europe (GMES) and similar initiatives;

Actions should map and monitor the environmental impact of mining activities with a focus on soil, water and air pollution and their possible impacts on the socio-economic and environmental health of mining areas.

-Develop best practices and standards for innovate EO technologies, products and services in the raw materials life cycle

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

Only terrestrial activities will be considered eligible.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2023-RESILIENCE-01-07: Expert network on Critical raw materials (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 3 million. |
| *Type of Action* | Coordination and Support Action |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |
| *Lump-sums* | **YES** |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Strengthening the expert capacity in the EU in a wide range of raw materials along the whole value chain;

-Better informed and more effective decision-making by the EU and National policy makers and the producers and users of raw materials regarding the supply and demand of raw materials and the associated environmental and social aspects;

-Improving EU official statistics and building the EU knowledge base of primary and secondary raw materials.

-Improving awareness of society across the EU about importance of the critical raw materials and other relevant materials for strategic value chains in support of the implementation of the green and digital transitions;

-In the longer term improved diversification of CRMs supply to the EU.

-Improve responsible supply of raw materials to the EU in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[38]](#footnote-39)

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[[39]](#footnote-40)

Scope:

Actions should strengthen an EU expert network and community covering all raw materials screened in the CRM assessment of 2020 , and once available also the raw materials of 2023 assessment. The consortium should organise the expert community across the EU covering expertise on primary and secondary resources; production, including exploration, mining, processing, recycling and refining; substitution of CRM; raw materials markets; future demand and supply; supply risk management and stress tests; materials flows; raw materials standardisation; socio-economic analysis, and strategic value chains and end-use sectors, including batteries, e-mobility, renewable energy, electronics, defence and aerospace.

The actions should improve data and knowledge on all screened raw materials; flexibly support the Commission in policy making related to Critical Raw Materials in general or linked to specific applications or sectors; as well in the relevant events organised by the Commission. The actions should also support the Commission in the analysis of the future supply and demand of raw materials, technology gaps and innovation potential along the raw materials value chains.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

**HORIZON-CL4-2024-RESILIENCE-01-08: Rare Earth and magnets innovation hubs (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 16 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Significantly improve supply security and reduced environmental footprint of rare earth value chains in the EU

-Broad access to materials development facilities and services across Europe through a single entry point – innovation hub;

-Accelerate development of products and processes for a faster market entry;

-Reduce costs for both industry and users and increased return on investment in research;

-Improve access to end users and easier marketability of products in Europe;

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[40]](#footnote-41)

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials[[41]](#footnote-42) and the action plan on Rare Earth Magnets and Motors from the European Raw Materials Alliance[[42]](#footnote-43).

Scope:

The action should create an innovation hub that enables the development, demonstration and testing of new processes for production of rare earths and related products, particularly neodymium permanent magnets in the industrial environments. This hub should connect critical mass of the existing laboratories, industrial pilots and other research facilities and services across different regions in the Europe and if duly justified also in third countries.

The hub should demonstrate its functionality on a range of concrete developments up to the TRL levels 6-7 to be executed within the duration of the action. Demonstrations could cover novel, cost-effective and environmentally sound rare earths extraction, processing and separation routes; consider unconventional rare earth sources, like low grade ores, non-ferrous metals beneficiation tailings and iron ore tailings, metallurgical waste apatite; and/or recycling, re-use, refurbishment and/or repurposing of end-of-life products and components containing rare earth magnets. The hub could additionally address development of breakthrough separation, fragmentation and magnetization approaches, finishing at TRL levels 4-5.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2023-RESILIENCE-01-09: Recyclability and resource efficiency of Rare Earth based magnets (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 6,7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 20 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Development of more cost effective and resource efficient rare earth permanent magnets.

-Improvement of recyclability ~~level~~ of end-of-life magnets.

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[43]](#footnote-44)

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials[[44]](#footnote-45) and the action plan on Rare Earth Magnets and Motors from the European Raw Materials Alliance[[45]](#footnote-46).

Scope:

ctions should improve design of rare earth permanent magnets that facilitate the reuse and recycling and/or reduce the use of the critical raw materials. Priority is neodymium magnets, but other highly performant magnets can also be targeted if duly justified. The actions should finish at the TRL levels 6-7. Developed improved magnets and their recyclability should be tested in the final application in relevant motors or generators.

Actions could additionally address disruptive technologies for highly performant magnets.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2024-RESILIENCE-01-09: Addressing due diligence requirements in raw materials supply chains. (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 2.2 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2.2 million. |
| *Type of Action* | Coordination and Support Action |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Improve responsible sourcing of raw materials and responsible business conduct initiatives with regard to raw materials;

-Equip the raw materials sector with tools to enable implementation of relevant regulatory initiatives;

-Identify and address gaps in the raw materials supply chains due diligence;

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-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[46]](#footnote-47)

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[[47]](#footnote-48)

Scope:

Responsible sourcing and due diligence are growing in importance throughout the raw materials value chain, highlighting the need to address possible risks of adverse impact to human rights and the environment in corporate behaviour. Consumers and investors increasingly expect supply chain transparency where due diligence obligations are an important part. Recent regulatory initiatives are underway for responsible sourcing and supply chain due diligence.

Knowledge in the area supply chain due diligence needs to be strengthened to limit complexity and enable a level playing field for responsible sourcing of raw materials.

The proposal should build on the state of the art in sustainable raw materials traceability and on the experience of existing EU projects on international responsible sourcing and contribute to strengthening responsible sourcing agenda.

Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

**HORIZON-CL4-2024-RESILIENCE-01-11: Technologies for extraction and processing of critical raw materials (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 7.5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 15 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Article 22.5* | *To increase EU resilience in raw materials supply chains and thus reduce the serious risks to the Union’s strategic assets, economic and societal interests, autonomy, and security associated with the current EU reliance on a few third countries for critical raw materials, by increasing sustainable and responsible sourcing of primary and secondary raw materials necessary to enable the green and digital transition and in alignment with the Communication (2020) 474 on Critical Raw Materials Resilience, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries, African Union Countries, and MERCOSUR, CARIFORUM, and Andean Community. The choice of these countries was made taking into consideration the development of strategic international partnerships on raw materials and avoidance of reinforcing existing over-dependencies, as well as the importance of involving partners committed to pursuing open trade in such materials. Proposals including legal entities which are not established in the countries that fall under the criteria above will be ineligible.* |

Expected Outcome:

Projects outcomes will enable achieving the expected impacts of the destination by increasing access to primary raw materials and secondary raw materials, in particular critical raw materials for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Strengthen EU cooperation with resource rich countries;

-Improved industrial viability, safety and environmental impacts of the operation in a way that leads to measureable improvements;

-Improve diversification EU sourcing of critical raw materials from third countries;

-Improve responsible supply of raw materials to Europe in line with the EU principles for sustainable raw materials, which are a non-regulatory set of principles based on the EU acquis. They set out requirements for sustainable raw materials and extraction and processing in Europe in terms of social, environmental and economic performance.[[48]](#footnote-49)

Dissemination and exploitation of projects outputs is tailored for organisations and industry dealing with raw materials in the EU and project partner countries in resource rich countries;

In order to achieve the expected outcomes, international cooperation with partners established inresource rich countries with which the EU has strategic partnerships on raw materials is strongly encouraged.

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[[49]](#footnote-50)

Scope:

The actions in this call should also be pursued with a view on developments in the call "HORIZON-CL4-2023/2024-RESILIENCE-01-02: Innovative technologies for sustainable and decarbonised extraction" in terms of industrial viability, safety and environmental impacts.

develop and demonstrate extraction and processing technologies to facilitate exploitation of the primary raw critical raw materials (minerals and metals only) for the EU to strengthen the EU supply chains.

The consortia should contain raw materials industry from partner country and raw materials users from the EU.

nternational collaboration is encouraged, particularly with Canada, following the strategic partnership on raw materials between the EU and Canada established in 2021.[[50]](#footnote-51) Technology should be demonstrated on the resources of the partner country.Actions should envisage clustering activities with other relevant selected projects for cross-projects co-operation, consultations and joint activities on cross-cutting issues and share of results as well as participating in joint meetings and communication events. To this end proposals should foresee a dedicated work package and/or task, and earmark the appropriate resources accordingly.

Actions should facilitate the market uptake of solutions developed through industrially- and user-driven multidisciplinary consortia covering the relevant value chain and should consider standardisation aspects when relevant. The action should also include the analysis of financial opportunities ensuring the market exploitation and replication of the circular business model behind the developed solutions as new processes, products and/or services.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. For TRLs 6-7, a credible strategy to achieve future full-scale manufacturing in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

In this topic the integration of the gender dimension (sex and/or gender analysis) in research and innovation content is not a mandatory requirement, however, should you consider it to be of relevance for your specific proposal, you are strongly encouraged to do it.

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## **Safe and Sustainable by Design (SSbD) Chemicals and Materials**

HORIZON-CL4-2023-RESILIENCE-01-21: Innovative methods for safety and sustainability assessments of chemicals and materials (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 30 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3 and achieve TRL 6 by the end of the project – see General Annex B. |
| *Lump Sum* | Yes |

**Links with topics in other WPs**

*Topics in CL6 developing safe and sustainable biomaterials (HORIZON-CL6-2023-ZEROPOLLUTION: Safe-and-sustainable-by-design bio-based platform chemicals, additives or products as alternatives).*

*Projects from HORIZON-CL4-2024-RESILIENCE-01-22, HORIZON-CL4-2024-RESILIENCE-01-23, HORIZON-CL4-2024-RESILIENCE-01-24*

*European Partnership on Assessment of Risks from Chemicals (PARC)*

*Project from HORIZON-CL4-2021-RESILIENCE-01-08 (Establishing EU led international*

*community on safe- and sustainable-by-design materials to support embedding*

*sustainability criteria over the life cycle of products and processes (CSA))*

Expected Outcome:

Proposals are expected to contribute to the following outcomes:

* Existing validation networks or bodies (e.g., EURL, ECVAM, EU-NETVAL and OECD) or other platforms wanting to engage in validation of new methods and/or models or in making them FAIR[[51]](#footnote-52) shall have access to results of projects in a standard format that will allow them to launch a validation process as required to promote wider uptake of the new methods and/or models;
* Standardisation bodies (OECD, ISO, CEN) should be fed with results of the projects as relevant for ongoing standardisation files;
* Industry and public authorities have access to innovative tools for more comprehensive safety and sustainability assessment covering a wider range of chemicals and advanced materials including composites/mixtures or nanomaterials, supporting the implementation of the Safe and Sustainable by Design framework and criteria[[52]](#footnote-53);
* EU strategies/policies and regulation, such as the Ecodesign for Sustainable Products Regulation [[53]](#footnote-54), EU Ecolabel[[54]](#footnote-55) or REACH[[55]](#footnote-56) can build on new methods and the associated data for chemicals and materials needed to assess their usability in the given context;
* Support the goals of the cancer[[56]](#footnote-57), oceans and water[[57]](#footnote-58), and soil[[58]](#footnote-59) missions by contributing to better protecting the citizens and the environment from pollution and hazardous substances.

Scope:

The future Commission initiative [cross-ref to footnote in outcome] for Safe and Sustainable by Design will set a framework for assessing safety and sustainability of chemicals and materials and should be considered as a baseline for proposals. This topic aims at developing new or refined methods to support the improvement of safety and sustainability assessment.

In the EU, the legislation regulating chemical substances often includes their safety screening and testing according to the EU test methods regulation[[59]](#footnote-60), which predominantly contains test methods standardised under the OECD[[60]](#footnote-61). For safety assessment, e.g., human and eco-toxicity, there is a lack of validated *in vitro* and *in silico* tools for a variety of substances and materials. New tools are needed to advance alternative methods (New Approach Methodologies, NAMs) without animal models, but also to support upfront modelling and design of new SSbD chemicals and materials. Research should improve and harmonise screening and testing protocols/strategies and hazard/risk assessments by developing robust, reliable and faster, test methods or models, including high-throughput and *in silico* models.

Sustainability aspects cover design phase, raw material extraction, production, use and end-of-life. Sustainability assessment across the life-cycle is in growing demand and there is the need to further develop methods towards a robust assessment. The integration of life cycle assessment with risk assessment is likewise a challenge. New and improved approaches are needed to increase the quality, the efficiency and the effectiveness of existing methods to drive innovation and to bridge data gaps required for sustainability and life-cycle assessments.

Proposals should consider all the following activities:

* Address a set of at least three chemicals/groups of chemicals/(advanced) materials for which the project consortium will develop new methods and models for safety and sustainability assessment along their life-cycle in accordance with the Safe and Sustainable by Design Framework [cross-reference footnote in outcome] (). Selected materials can be composed of/contain the selected chemicals. The justification for their selection should include socio-economic aspects and a gap analysis with regards to existing methods and models and their relevance to improve current safety and sustainability assessment;
* Methods and models developed can be either for existing chemicals and materials or to be used during the design phase of new chemicals and materials;
* For each method or model developed an ‘in project’ validation should be done and the method or model shall be shared via the most appropriate open platform, e.g. PARC[[61]](#footnote-62), to encourage use and feedback from stakeholders. In addition, an initial standardisation or validation dossier should be prepared and submitted to an appropriate body/initiative, e.g. the OECD.
* Data produced during the development process and in particular for inclusion in the validation/standardisation dossier must be FAIR[[62]](#footnote-63) and shared though available platforms (e.g. IPCHEM[[63]](#footnote-64), Chemicals data platform[[64]](#footnote-65) ). Data for the validation/standardisation dossier shall be produced according to existing guidelines and stored in standardised data formats[[65]](#footnote-66). (

Enhance international collaboration on uptake of new methods and/or models involving relevant players from academia, public authorities and private sector. Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[[66]](#footnote-67) they will contribute to.

Proposals submitted under this topic should demonstrate synergies with relevant Horizon 2020 and Horizon Europe projects and partnerships (especially the CSA resulting from the topic HORIZON-CL4-2021-RESILIENCE-01-08, the PARC partnership and other projects resulting from this topic). Proposals should allocate the necessary resources for collaboration with other relevant projects. Proposals should also build on the extensive experience from European, national or regional clusters/platforms and initiatives such as the Malta Initiative[[67]](#footnote-68).

Research should build on existing standards (test guidelines and guidance documents) or contribute to standardisation, when relevant at OECD level. Interoperability for data sharing should be addressed. International cooperation is encouraged.

HORIZON-CL4-2023-RESILIENCE-01-22: Integrated approach for impact assessment of safe and sustainable chemicals and materials (RIA)

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| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (3-4 projects), |
| *Indicative budget* | The total indicative budget for the topic is EUR 15 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL 2-5 by the end of the project – see General Annex B. |

**Links with topics in other WPs**

*Topics in CL6 developing safe and sustainable biomaterials (HORIZON-CL6-2023-ZEROPOLLUTION: Safe-and-sustainable-by-design bio-based platform chemicals, additives or products as alternatives).*

*Projects from HORIZON-CL4-2024-RESILIENCE-01-21, HORIZON-CL4-2024-RESILIENCE-01-23, HORIZON-CL4-2024-RESILIENCE-01-24*

*European Partnership on Assessment of Risks from Chemicals (PARC)*

*Project from HORIZON-CL4-2021-RESILIENCE-01-08 (Establishing EU led international*

*community on safe- and sustainable-by-design materials to support embedding*

*sustainability criteria over the life cycle of products and processes (CSA))*

*Projects from HORIZON-HLTH-2022-ENVHLTH-04-01 (Methods for assessing health-related costs of environmental stressors)*

Expected Outcome:

Proposals are expected to contribute to the following outcomes:

1. The stakeholder community, including designers, industry, public authorities, NGOs, engaged citizens, and decision makers in general, will be enabled to:
   * Include an integrated assessment of economic, human health and environmental impacts of chemicals and materials in decision making;
   * Use clear impact scenarios which can raise awareness of boundary conditions and enable an informed discussion on required policy actions and trade off analysis;
   * Follow common guidelines and methodologies for integrative economic, health and environment impact assessments and include the integrated approach in their models;
2. Support the EU climate ambitions[[68]](#footnote-69) by contributing to highlighting integrated impacts of the production and use of chemicals and materials and thereby facilitate actions for increased sustainability;
3. Support the goals of the cancer[[69]](#footnote-70), oceans and water[[70]](#footnote-71), and soil[[71]](#footnote-72) missions by better protecting the citizens and the environment from pollution and hazardous substances ;

Scope:

The future Commission initaitive[[72]](#footnote-73) for Safe and Sustainable by Design will set a framework for assessing safety and sustainability of chemicals and materials and should be considered as a baseline in the proposal.

Proposals should aim to develop integrated methods and models for the assessment of health and environmental impacts together with a socioeconomic analysis, all along the life-cycle of a chemical or material. The projects should acknowledge and account for the fact that safety and sustainability of a chemical or material is the result of a mix of intrinsic properties (dependent only on the chemical or material itself) and extrinsic properties (dependent on how the chemical or material is produced or used, and in which quantity). The proposals should also aim to foster the acceptance of the developed approaches as good practice. The developed models should support and facilitate decision making when having to weight different safety and sustainability criteria against each other in terms of costs and impacts. The developed models should contribute to the estimation of health, environmental and socio-economic impacts at global scale.

Proposals should consider all the following activities:

* Address selected chemicals/group of chemicals/(nano)materials for which they will develop an integrated approach for health, and socio-economic impact assessments) and justify this selection in view of its societal relevance;
* Identification of data gaps and data availability along the value chain as regards all environmental, health and socio-economic factors for the targeted substance/group of substances and related tangible and intangible costs and recommendations on priorities for new data collections;
* Development of innovative methods and models, and associated guidelines for integrated health, environment and cost-benefit impact assessments;
* Consultation of various stakeholders along the value chain on methods and models developed to foster a shared agreement on these;
* Delivery of FAIR[[73]](#footnote-74) data to an open knowledge data base including results, methodologies and data appropriate for re-use, data verification and curation, quality management, auditing and accreditation systems[[74]](#footnote-75).

Proposals submitted under this topic are strongly encouraged to participate in networking and joint activities with other successful proposal from this topic and from HORIZON-CL4-2023-RESILIENCE-01-21.. Concerning health impact assessment projects are encouraged to seek for coordination with projects resulting from the call ‘HORIZON-HLTH-2022-ENVHLTH-04-01. Models under development as well as final models should be made available for further use and dissemination to e.g. PARC[[75]](#footnote-76) and projects funded under the topic HORIZON-CL4-2021-RESILIENCE-01-08[[76]](#footnote-77) ~~for referencing on their websites.~~ Proposals should allocate the necessary resources for collaboration with the above defined relevant projects.

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[[77]](#footnote-78) they will contribute to.

Research should build on existing standards (test guidelines and guidance documents) and contribute to standardisation. Interoperability for data sharing should be addressed.

Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in social and economic assessments, to achieve efficient integration of techno-economic, safety and life cycle assessment.

HORIZON-CL4-2023-RESILIENCE-01-23: Computational models for the development of safe and sustainable by design chemicals and materials (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 4 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (6-7 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 30 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL 3-6 by the end of the project – see General Annex B. |

**Links with topics in other WPs**

*Topics in CL6 developing safe and sustainable biomaterials (HORIZON-CL6-2023-ZEROPOLLUTION: Safe-and-sustainable-by-design bio-based platform chemicals, additives or products as alternatives).*

*Projects from HORIZON-CL4-2024-RESILIENCE-01-21, HORIZON-CL4-2024-RESILIENCE-01-22, HORIZON-CL4-2024-RESILIENCE-01-24*

*European Partnership on Assessment of Risks from Chemicals (PARC)*

*Project from HORIZON-CL4-2021-RESILIENCE-01-08 (Establishing EU led international*

*community on safe- and sustainable-by-design materials to support embedding*

*sustainability criteria over the life cycle of products and processes (CSA))*

*Made in Europe – to be discussed*

Expected Outcome:

Projects are expected to contribute to the following outcomes:

* The innovation capacity of European SMEs and industry will be boosted with cost effective tools to find safe and sustainable alternatives to substances of concern;
* The European chemicals and materials community will be provided with computational models supported by artificial intelligence for the design of new chemicals and materials integrating functionality and the Safe and Sustainable by Design framework[[78]](#footnote-79);
* Industry will lower the environmental footprint of materials and chemicals through improved production methods, optimised applications from the design phase on:
* Improve the agility of European industry responses to external and internal influences, e.g. new market demands for chemicals and advanced materials, regulatory requirements or the potential shortage of currently used raw materials;
* The EU climate ambitions[[79]](#footnote-80) will be supported by contributing to a decrease of greenhouse gas emissions through a more sustainable production and use of chemicals and materials;
* The goals of the cancer[[80]](#footnote-81), oceans and water[[81]](#footnote-82), and soil[[82]](#footnote-83) missions better protecting the citizens and the environment from pollution and hazardous substances.

Scope:

The future Commission initiative [cross reference to footnote in outcome] for Safe and Sustainable by Design will set a framework for assessing safety and sustainability of chemicals and materials and should be considered as a baseline in the proposal.

For an effective and climate-neutral substitution of substances of concern[[83]](#footnote-84) it is crucial that the developed alternatives provide the functionality that is required of those that are replaced (e.g. water or dirt repellent properties, insulation, etc.), and have an improved safety and sustainability performance. The integration by computational modelling of the chemicals and materials functionality with SSbD criteria will have a key role in the green and digital transition of European industry. These tools will allow the exploration of which technical solutions are the most appropriate in a cost- and policy-effective manner and accelerate the innovation process for SSbD chemicals and materials.

Proposals should therefore:

* Develop innovative modelling software available and interlinked through open platforms accessible to SMEs and industrybuilding on high-throughput chemicals and materials characterisation facilities and relevant models,
* Enable the integration of materials modelling, safety and sustainability assessment tools and databases into a single work-flow. Apply AI techniques for data search and missing data, including statistical analysis (sensitivity and uncertainty), in all the areas covered: modelling of the functionality, safety and sustainability assessment (including life cycle assessment);
* Address information exchange on chemicals and materials along value chains and throughout their life-cycle and provide solutions for data accessibility in the different steps of the value chain for modelling/assessment purposes;
* Make developed models on chemicals, materials and their production process FAIR.
* Apply FAIR data principles. The interoperability for data sharing should be addressed, including synergies with other European project addressing ontologies for data documentation, for example DT-NMBP-39-2020[[84]](#footnote-85);
* Explore collaboration with existing Open Innovation Test Beds (OITBs)[[85]](#footnote-86), where relevant;
* The tools should be validated against measurements and existing data. Application of the tools by external users should be tested within the project (industry and SMEs outside the project consortium, liaise eventually with projects resulting from the calls on strategic innovation markets driven by advanced materials).

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[[86]](#footnote-87) they will contribute to.

Research should build on existing standards, where possible, and contribute to standardisation.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

A strategy for skills development should be presented, associating social partners when relevant.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. For example, the European partnership for the assessment of risks from chemicals [[87]](#footnote-88) (PARC) and projects resulting from the topics HORIZON-CL4-2021-RESILIENCE-01-08[[88]](#footnote-89) and HORIZON-CL4-2024-RESILIENCE-01-21, HORIZON-CL4-2024-RESILIENCE-01-24.Proposals should allocate the necessary resources for collaboration with other relevant projects. .

HORIZON-CL4-2024-RESILIENCE-01-24: Development of safe and sustainable by design alternatives (IA)

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| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 12 and 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is 60 EUR million in 2024 |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL 5-8 by the end of the project – see General Annex B. |
| *Lump Sum* | Yes |

**Key Policy Trackers**

**Links with topics in other WPs**

*Topics in CL6 developing safe and sustainable biomaterials (HORIZON-CL6-2023-ZEROPOLLUTION: Safe-and-sustainable-by-design bio-based platform chemicals, additives or products as alternatives).*

*Projects from HORIZON-CL4-2024-RESILIENCE-01-21, HORIZON-CL4-2024-RESILIENCE-01-22, HORIZON-CL4-2024-RESILIENCE-01-23*

*European Partnership on Assessment of Risks from Chemicals (PARC)*

*Project from HORIZON-CL4-2021-RESILIENCE-01-08 (Establishing EU led international*

*community on safe- and sustainable-by-design materials to support embedding*

*sustainability criteria over the life cycle of products and processes (CSA))*

*Made in Europe/Process4Planet – to be discussed*

Expected Outcome:

Projects are expected to contribute to the following outcomes:

* European industry will have access to safer and more sustainable alternatives with reduced substitution barriers (e.g. performance, cost and supply demand);
* Industry will be able to demonstrate relevant scale production of innovative chemicals or materials to substitute those of concern in compliance with the Safe and Sustainable by Design framework[[89]](#footnote-90);
* The EU climate ambitions [[90]](#footnote-91) will be supported by contributing to a decrease of greenhouse gas emissions through a more sustainable production and use of Safe and Sustainable by Design chemicals and materials;
* The cancer[[91]](#footnote-92), oceans and water[[92]](#footnote-93), and soil[[93]](#footnote-94) will be supported by contributing to better protecting the citizens and the environment from pollution and hazardous substances.
* The proof of concept of developing new Safe and Sustainable by Design chemicals or materials will bring evidence for new skills needed to apply Safe and Sustainable by Design criteria;
* Market uptake of the Safe and Sustainable by Design chemicals and materials will be encouraged by citizens better understanding the benefits.

Scope:

The future Commission initiative [cross-reference to footnote in outcome] for Safe and Sustainable by Design will set a framework for assessing safety and sustainability of chemicals and materials and should be considered as a baseline in the proposal.

Proposals should design, develop and integrate new chemical substances or materials to replace existing substances of concern with surfactant, flame retardant or plasticising functionalities. Proposal should select one or more of them and address at least one industrial application. The new substances or materials shall be compliant with the Safe and Sustainable by Design criteria[[94]](#footnote-95) published by the European Commission. The selected industrial application areas should be where substitution with safer and more sustainable solutions is not yet in place, or in progress.

Proposals should address all of the following:

* Proof of concept of Safe and Sustainable by Design criteria. The developed substances or materials will have to comply with the Safe and Sustainable by Design framework defined . Findings from the selected projects will be considered for the further refinement of the defined criteria, if applicable;
* The selection of the chemical/materials to be developed should be justified with a technology and socio-economic analysis;
* Identify the substitution barriers for the selected applications and propose driving mechanism for a full substitution in the targeted value chains;
* Identify and address challenges for the adaption of existing production lines;
* Explore collaboration with existing Open Innovation Test Beds (OITBs), where relevant;
* Interoperability for data sharing should be addressed across the entire value chain. Proposals should involve the relevant actors along the value chain[[95]](#footnote-96).
* Communication actions to all stakeholders and specifically citizens about the benefits of the developed Safe and Sustainable by Design chemicals and materials.

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[[96]](#footnote-97) they will contribute to.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in the socio-economic analysis of the relevant substance or application.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. For example, HORIZON-CL4-2021-RESILIENCE-01-08[[97]](#footnote-98) as well as other relevant projects from the calls HORIZON-CL4-2024-RESILIENCE-01-21, HORIZON-CL4-2024-RESILIENCE-01-22, HORIZON-CL4-2024-RESILIENCE-01-23and PARC[[98]](#footnote-99) with regards to the Safe and Sustainable by Design toolbox under development. Proposals should allocate the necessary resources for collaboration with other relevant projects.

## **Strategic Innovation Markets Driven by Advanced Materials**

**HORIZON-CL4-2023-RESILIENCE-01-32: Bioinspired and biomimetic materials for smart fabrics and sustainable textiles (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 4 and achieve TRL 5-7 by the end of the project – see General Annex B. |

**Key Policy Trackers**

**Links with topics in other WPs**

Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment' and Circular Bio-based Europe JU (CBE JU).

Expected Outcome:

This topic refers to the innovation market for *Sustainable Textiles*, and will support citizens and their needs. Several materials specifications and related innovations needs will support this topic such as renewable and recyclable materials, alternative active ingredients, design for circularity. The topic should address several key policies of the European Union such as Circular Economy Action Plan, Zero Pollution Action Plan, EU Chemicals strategy, EU strategy for sustainable textiles.

Projects are expected to contribute to the following outcomes:

* The innovation market of sustainable textiles requires the use of a new generation of renewable and recyclable materials designed with properties that are inspired by nature.
* Bioinspired and biomimetic advanced materials that do not require chemical additives or coatings will have a positive impact on the environment and the circularity of textile materials, in view of SSbD.
* Smart functions or functionalities of textiles will address the advanced consumer market.
* Designed circularity for renewables and recyclable materials supporting the sustainable use of textiles.

Scope: Proposals should address one of the following activities:

* Bio-inspired and biomimetic polymers for use as smart textile materials will provide improved functionalities e.g. for outdoor use.
* The molecular functionalities of natural polymers, and their macromolecular structures and properties, provide inspiration for designing different classes of high-performance polymeric materials that aim to reproduce specific functions of natural polymers, such as adaptability, self-healing, adhesiveness, surface super-hydrophobicity, chiral recognition, and bioactivity.
* Biodegradability and recyclability of polymers will be a factor, so the consideration of natural polymers, such as polysaccharides, proteins, Lignin based polymers and composites could be a pathway.
* Projects must prove scalability of biomimetic materials for the manufacturing process of smart fabrics and sustainable textiles.
* To enable a fast development of new advanced materials, digital tools such as modelling, simulation and characterisation techniques (including those provided by analytical infrastructures) are under the scope, assisted by advanced methods e.g. physics-based methods, machine learning or artificial intelligence.
* Dove-tailing with digital technology e.g. sensors is encouraged.
* Materials and products have to be developed under with a Safe and Sustainable by Design principle and taking into account circularity aspects, and with prognostic and product health management to ensure product and system reliability.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

**HORIZON-CL4-2023-RESILIENCE-01-33: Smart sensors for the home and personal products market (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B. |
| *Lump Sum* | Yes |

**Links with topics in other WPs**

*Topics in*

Cluster 1 ‘Health’ and Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment'.

Expected Outcome:

This topic refers to the innovation market for *Home & Personal Care*, in support of citizens and their needs. Several materials specifications and related innovations needs will support this topic such as renewable and recyclable materials, alternative active ingredients, design for circularity The topic should address several key policies of the European Union such as Circular Economy Action Plan, Zero Pollution Action Plan, EU Chemicals strategy, EU strategy for sustainable textiles.

Sensors are a key technology for our society. From manufacturing, improving living conditions, and reducing consumption of energy and precious natural resources, even detecting threats, all rely on the availability of high-quality localized information.

Smart systems and ubiquitous connectivity create opportunities for new applications in smart living, environmental protection, and supply chains. These applications will be made possible through improved sensing technologies, which capture the relevant information. Core properties to enable a wide adoption are miniature size, low power consumption, resilience to varying ambient conditions, low cost, and compatibility with mass production.

To avoid misuse of the captured personal data (e.g. medical), novel concepts of identification of the data originator/provider and data possession are needed. This could include biometric identification mechanisms as well as other fast and secure identification mechanisms, which is GDPR conform and with protected authorisation mechanisms.

The desired information is often chemical or biochemical. Miniaturization of established analytical methods and development of new materials compatible with established production processes require an integrated multidisciplinary approach.

Projects are expected to contribute to the following outcomes:

* The Innovation market for Home and Personal care, self-monitoring in fitness and well-being, and decentral personal health monitoring, is very broad and fast developing with a range to monitor human and environmental factors, which require to develop materials for a new generation of fast and smart sensors devices.
* Distributed smart sensor technology can also support environmental monitoring, supply chain management.
* Sensor devices must be small, and durable to deploy at various locations and withstand the ambient conditions of the targeted application.
* Advanced materials are needed to allow the capturing of chemical and bio-chemical signals with extended lifetime or extreme low cost for disposable sensors.
* Smart concepts and tools for evolving data analysis that embed a deep understanding of the sensor properties enable new business models for distributed, connected sensors.

Scope: Proposals should address one or several the following activities:

* Biosensors and chemical sensors can be applied to detect and monitor analytes or pathogens in the environment, health, and food industries in an efficient and timely manner. Fast scanning and sensor-based devices that can be deployed at a large scale could augment or replace traditional methods of measurement and quality control.
* Advanced biological or biomimetic sensing elements for the measurement of biomarkers allow for new compact analytical devices or be integrated in personal devices such as smart phones, smart watches, and body sensors.
* New materials with properties such as stretchability, self-healing and self-cleaning for use in wearable electronics and smart textiles enable next-generation devices for the health and sports sector.
* To enable a fast development of new advanced materials, digital tools such as modelling, simulation and characterisation techniques (including those provided by analytical infrastructures) are under the scope, assisted by advanced methods e.g. physics-based methods, machine learning or artificial intelligence.
* Connected smart sensors allow for new data analysis concepts. Algorithms may be adapted throughout the lifetime of the deployed devices, improving their functionality through data-fusion with additional data sources, adaptation to new requirements or enabling of big-data scenarios.
* Digitalisation technologies for PoC (Point-of-Care), PoN (Point-of-Need), home, and in-vivo/in-vitro diagnostics (e.g. sensors, sensor-arrays, sustainable system integration incl. microfluidics; machine learning approaches).
* Materials and products have to be developed under with a Safe and Sustainable by Design principle and taking into account circularity (life handling and recycling).

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Projects should build on or seek collaboration with existing projects and develop synergies with otherThis topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities. An early involvement of end users could be essential.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

**HORIZON-CL4-2023-RESILIENCE-01-34: Advanced (nano)materials for sustainable agriculture (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Lump Sum* | Yes |

**Links with topics in other WPs**

*The projects under this topic are obliged to cooperate with projects under following topics:*

*Topics in CL6 developing safe and sustainable biomaterials (HORIZON-CL6-2023-ZEROPOLLUTION: Safe-and-sustainable-by-design bio-based platform chemicals, additives or products as alternatives).*

*Projects from HORIZON-CL4-2023-RESILIENCE-01-21: Innovative methods for safety and sustainability assessments of chemicals and materials (RIA), and from HORIZON-CL4-2023-RESILIENCE-01-22: Integrated approach for impact assessment of safe and sustainable chemicals and materials (RIA).*

Expected Outcome:

Projects are expected to contribute to the following outcomes:

* Agrochemical industries will provide alternative chemicals following the safe and sustainable by design framework to farmers so that the latter can offer better food and feed products to retailers and end consumers.
* Advanced (nano)materials will enable both farmers to decrease dependency on pesticides and avoid excessive fertilisation and demonstrate a much lower environmental footprint.
* Support the EU climate ambitions[[99]](#footnote-100) by contributing to reversing biodiversity loss and to more sustainable food production as well as the objectives of the Zero Pollution Action plan and the Chemicals Strategy for Sustainability.
* Support the EU goals of the soil mission[[100]](#footnote-101), i.e. better protecting the citizens and the environment from pollution and hazardous substances.

Scope:

This topic refers to the innovation market[[101]](#footnote-102) for Sustainable Agriculture. The next generation of fertilisers, pesticides or plant protection products for agriculture should be based on new delivery systems made from advanced (nano)materials (nanosubstances and nanoformulations of conventional substances).

Proposals should address all the following activities:

* Develop advanced (nano)material-based delivery systems for agriculture. The new agrochemicals should exhibit less GHG emissions, improved efficiency, biocompatibility and biodegradability to overcome the problems of traditional agrochemicals (e.g., pest resistance, bioaccumulation in non-target fauna or flora, soil, groundwater, as well as bioaccumulation and bioconcentration in the food chain due to release to the environment).
* Each proposal should identify and address one or more (nano)active substances or delivery systems for (nano)formulations for which they will provide safety assessment including toxicity evaluation for non-target organism and human and sustainability assessment along their entire life-cycle. The safety and sustainability assessment should be done according to the Safe and Sustainable by Design framework[[102]](#footnote-103).
* Proof of concept of the efficiency of the selected delivery systems in real-life case studies. The justification for the selection of materials for new agrochemicals as well as case studies (e.g., type of crop for agrochemicals testing, etc.) should include socio-economic aspects.
* The proposals should build on existing standards for production and risk assessment, when available and relevant, and on specific guidance for risk assessment of the selected delivery systems (e.g., the EFSA Guidance on risk assessment of nanomaterials to be applied in the food and feed chain[[103]](#footnote-104) or the EFSA guidance on specific protection goal and ecosystem services[[104]](#footnote-105) for environmental assessment and sustainability.
* Data produced during the development of new agrochemicals should be FAIR[[105]](#footnote-106) and the FAIRness should also be demonstrated and shared through available platforms (e.g., IPCHEM[[106]](#footnote-107), e-NanoMapper[[107]](#footnote-108), etc.).
* Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes, clusters (e.g., Nanosafety Cluster) and platforms, in particular with the European Platform on Life Cycle Assessment (EPLCA)[[108]](#footnote-109).

Proposals should involve end users and appropriate expertise in Social Sciences and Humanities (SSH), in particular in social and economic assessments.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

**HORIZON-CL4-2023-RESILIENCE-01-35: Biodegradable polymers for sustainable packaging materials (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 4 and achieve TRL 5-7 by the end of the project – see General Annex B. |

**Links with topics in other WPs**

*Topics in*

Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment' and Circular Bio-based Europe JU (CBE JU).

This topic refers to the innovation market for *Sustainable Packaging*, which affects many citizens and their needs. Several materials specifications and related innovations needs will support this topic such as renewable and recyclable materials, sustainable additives and catalysts, alternative active ingredients, design for circularity The topic should address several key policies of the European Union such as Circular Economy Action Plan, Zero Pollution Action Plan, EU Chemicals strategy.

Biodegradable polymers and derived plastics can provide waste management solutions for specific applications, including packaging. At present, the production of plastics for packaging and bottling is largely based on fossil-based feedstock, such as polyethylene (PE), polypropylene (PP) and polyethylene terephthalate (PET), which are not biodegradable. Unrecycled plastics cause environmental pollution when ending up in landfills, or as litter in the natural environment; and cause carbon emissions and pollution when used for the generation of energy.

Expected Outcome: Projects are expected to contribute to the following outcomes:

* The packaging industry will have access to the next generation of biodegradable polymer materials, which will also be recyclable materials. Plastic materials producers will switch from PP, PE, and PET to bio-degradable materials with reduced GHG emissions along the value chain.
* The packaging industry will apply business modelmodels of circularity for -by-design and sustainable end-of-life (EoL) solutions for packaging materials. This has the potential to lead to a reduction in landfill waste volume of packaging materials; and to a reduction of littering of plastics, coherent with the ambition of the Horizon Europe Mission on Oceans to reduce to plastic pollution of the oceans. Projects are expected to contribute to the Plastics strategy, the Single-use Plastics Directive and the EU Circular Economy Action plan (CEAP).
* Standards and labels for specific applications will be further defined based on the development of testing of biodegradability of plastics in open environments

Scope:

Proposals should address the following activities:

* Develop new , demonstrate and scale-up novel advanced bio-degradable polymer materials ~~polyesters (e.g. PHB, PLA, PGA, PCL, PBS and PHAs bio-degradable polymers)~~ that canand innovative processes that will allow the bio-degradable polymers to be produced at a large scale with a similar economy of scale to replace present production with PE, PP and PET, and with an improved sustainability profile compared to present production and EoL characteristics.
* Developing sustainable additives and catalysts to support the production of bio-degradable polymers.
* Provide evidence with life-cycle and techno-economic assessment (LCA/TEA) that the cost for the novel advanced biodegradable polymer products are not significantly higher compared to existing polymer products (PE, PP, PET) on the market.
* Scaling up the production of packaging materials at pilot level.
* Develop and demonstrate circular business modelmodels for production at industrial level, where the release of GHG emissions is ; andassesssignificantly reduced; and assess the potential of secondary raw materials as a feedstock (including from renewable sources) for the production of bio-degradable polymers,.
* Identification and testing of the biodegradability pathways in all environmentally relevant conditions (for the application of the developed material in relevant shape or form); and extensive quantified risk analysis from both a human and environmental perspective for all the different intermediate and end products of biodegradation, including quantification of the contribution to GHG emissions. Contribute to further defining standards and labels for specific applications.
* Modelling of the lifetime of the developed polymers along the biodegradation pathway in environmentally relevant conditions, both in natural, (terrestrial and marine), and in waste processing environments.
* DemonstrationDemonstrate complete biodegradability in all relevant conditions and environmental compartments (e.g. landfill, compost site, litter in marine-freshwater-sediment-soil) within acceptable timeframes, determination of the main influencing environmental conditions; and assessment of the impact on the environment. Integrate a holistic sustainability assessment, accounting for the full lifecycle (including sourcing of feedstock).

To enable a fast development of new advanced materials, digital tools such as modelling, simulation and characterisation techniques (including those provided by analytical infrastructures) are under the scope, assisted by advanced methods e.g. physics-based methods or artificial intelligence. (inclunding machine learning).

~~Currently, under the Chemical Strategy for Sustainability, the Safe and Sustainable by Design criteria are being developed. Since this topic includes the development of new chemicals, the proposal is expected to demonstrate adherence to the Safe and Sustainable by Design philosophy (anticipating any safety or sustainability issues in the production, use, or after-use phases).~~

The future Commission initiative[[109]](#footnote-110) for Safe and Sustainable by Design will set a framework for assessing safety and sustainability of chemicals and materials and should be considered as a baseline in the proposal.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities. An early involvement of end users could be essential.

Projects should build on or seek collaboration with existing projects (e.g. Open Innovation Testbeds) and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. Where relevant, proposals should seek links with and capitalise on the results of past and ongoing EU funded research projects, including the ones under Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment' and Circular Bio-based Europe JU (CBE JU).[[110]](#footnote-111)

**HORIZON-CL4-2024-RESILIENCE-01-36: Advanced biomaterials for medical applications (IA)**

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| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B. |
| *Lump Sum* | Yes |

**Links with topics in other WPs**

*Topics in*

Cluster 1 ‘Health’ and Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment'.

Expected Outcome:

This topic refers to the innovation market for *Healthcare and Medicine*, which affects many citizens and their needs. Several materials specifications and related innovations needs will support this topic such as renewable and recyclable materials, alternative active ingredients, design for circularity, lightweight materials, The topic should address several key policies of the European Union such as Circular Economy Action Plan, EU Chemicals strategy.

Projects are expected to contribute to the following outcomes:

* Medical and/or surgical procedures will benefit from injectable materials for non-invasive surgical procedures.
* Some of their advantages include easy deliverability into the body, increased implantation precision, controllable release of therapeutic agents, antimicrobial properties and the possibility of monitoring or stimulating biological events.
* Medical suppliers can commercialise injectable hydrogels, including those made of nanocomposite, natural and synthetic polymer-based biomaterials, bone cements, bio-ceramics and electronics.

Scope: Proposals should address the following activities:

* To enable a fast development of new advanced novel injectable biomaterials , digital tools such as modelling, simulation and characterisation techniques (including those provided by analytical infrastructures) assisted by advanced methods e.g. physics-based methods, machine learning or artificial intelligence.
* The innovation market of medical applications is fast growing and dependent on advanced biocompatible materials that can be printed or injected. The 4D materials will change their 3D structures after external impact such as thermic, electric, mechanical or radiation treatment.
* The topic has to develop new engineering strategies that present functional characteristics beyond bio-compatibility, and express properties that can be used to control the physiological environment (shape-memory, self-healing properties) and induce a response.
* The topic can address biomaterials with antibacterial properties contributing to the widespread bottleneck of antimicrobial resistance often encountered in clinical care
* The design for circularity has to develop bio-degradable or bio-absorbable biomaterials that are gradually eliminated by the body after fulfilling a purpose
* The used biomaterials should be safe and sustainable by design (SSbD), taking also into account any specific medical requirements.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities. An early involvement of end users could be essential.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

**HORIZON-CL4-2024-RESILIENCE-01-37: Advanced materials for magnets in applications for the new energy and mobility innovation market (RIA)**

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| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.  (4-5 projects) |
| *Indicative budget* | The total indicative budget for the topic is EUR 32 million in 2023 |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B. |

**Links with topics in other WPs**

*Topics in*

Cluster 5 ‘Climate, Energy and Mobility’.

Expected Outcome: Projects are expected to contribute to the following outcomes:

This topic refers to the innovation markets for *New Energy* and for *Sustainable Transportation*. Several materials specifications and related innovations needs will support this topic such as renewable energy and efficiency, renewable and recyclable materials, sustainable additives and catalysts, advanced surfaces, design for circularity The topic should address several key policies of the European Union such as Circular Economy Action Plan, Zero Pollution Action Plan, A New Industrial Strategy for Europe also in view of critical and strategic raw materials for energy storage and conversion.

Projects are expected to contribute to the following outcomes:

* In order to deliver the EU's 2030 climate targets under the ‘Fit For 55’[[111]](#footnote-112) delivering EU's 2030 climate targets, Europe will need an increasing number of advanced systems for energy transformation for wind turbines and electric drive trains. For this, European industry needs high performance magnets using advanced materials solutions for the new energy innovation market, which isin future shall contain lesser amounts of rare-earth metals, in view of the geostrategic dependent atdependency on rare-earth metals and critical raw materials.
* Europe’s industry will benefit from advanced materials for magnets that are either free from rare-earth metals, or a significant substitute and reduce the share of rare-earth metals mangets(compared to the state of art)). This will alleviate the dependency and possible supply risks and strengthen Europe’s strategic autonomy and competitiveness.
* The new advanced materials for high-performance magnets must be available at an industrial scale and shall have improved energy-efficiency and performance, whilst at the same time will be easier to recycle with longer and enhanced life cycle.
* This is in particular necessary to keep up with the political ambitions of the European Green Deal matching the increasing demand for energy harvesting and storage with the ambition to reduce emissions.

Scope: Proposals should address several of the following activities:

* Rare-earth metals for magnets shall be replaced or reduced with inexpensive and non-critical materials.
* Designing new rare-earth-free permanent magnetic materials (PMM) to replace high performing but critically restrained rare-earth-based PMM could be based for example on new Mn-Bi alloys, other material compositions could also be proposed. As an alternative strategy composite magnetic materials could be developed. Rare earth-free magnets for turbines with good efficiency levels were already developed and could be further adopted. Projects must demonstrate 50% enhanced magnetic performance (energy products above 55 kJ/m3) with respect to commercial ferrites.
* Alternatively, the redesigning of rare-earth magnets such as NdFeB magnets should provide for advanced materials where rare-earth metals such as Nd are (partially) replaced. rareRare earth-doped perovskite manganite oxide nanostructures with a chemical composition of LnxA1-xMnO3 (where Ln represents rare earth metal elements such as La, Pr, Nd, A is divalent alkaline earth metal elements such as Ca, Sr, Ba) could achieve similar magnetic properties such as NdFeB magnets.
* Life-cycle assessment and techno-economic assessment (LCA/TEA) will analyse the economic relevance of the new advanced materials for magnets. This will also address aspects of circularity, and end-of-life aspects. Strategies for the recycling of the new advanced materials will support the whole design process.
* Delivering a scaling will increase the production to an industrial level for advanced materials for magnets that are rare-earth metal free or where rare-earth metals are substituted .
* To enable a fast development of new advanced materials, digital tools such as modelling, simulation and characterisation techniques (including those provided by analytical infrastructures) are under the scope, assisted by advanced methods e.g. physics-based methods, machine learning or artificial intelligence.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

An early involvement of SSH research and of end users appears essential.

Additionally, a strategy for skills development should be presented.

**HORIZON-CL4-2023-RESILIENCE-01-39: Reinforcing coordination and knowledge sharing across material development communities based on digital technologies (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR 2 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2 million in 2023 |
| *Lump Sum* | Yes |

Expected Outcome: Projects are expected to contribute to the following outcomes:

1. A pathway for accelerating advanced material research and overcoming hurdles with regards to access to data and digital tools.
2. A common knowledge base for researchers and industry increasing collaboration between innovation markets.

Scope:

There is a need to integrate and unify digital and materials competences and resources, in modelling, characterisation, robotics, data, ontologies and machine learning, to accelerate the design, development, production and application of advanced materials. This will address the challenges of the innovation markets of the Materials 2030 Manifesto. There should be collaboration with existing European data spaces across the whole value chain on interfaces and metadata, in order to ease the access and improve the use of materials data.

Platforms integrating materials data management, modelling, characterisation and harnessing machine learning and automation have the potential to accelerate the design, development and upscaling of new advanced materials by a time factor of 5-10 and decrease the costs associated with innovation chain and market exploitation.

Actions are required that ensure synergies and common approaches, to capitalise on commonalities and to ensure interoperability, also across value-chains and innovation markets.

Proposals should:

* Establish an inventory of relevant existing collaborative platforms, databases and infrastructures the nine innovation markets defined in the Material 2030 Manifesto;[[112]](#footnote-113)
* Network the identified databases and other resources, and make them accessible and usable for the developer’s community;
* Identify minimum requirements to make this network attractive to users;
* Establish a cost overview and a business plan for the sustainability for such a network;
* Establish a long-term multi-stakeholder, interdisciplinary network of materials scientists and digital scientists from academia and industry involved in advanced materials development and deployment, to ensure the sustainability of the solutions found;
* Ensure interoperability between data and methods developed under different activities, exploit synergies with Commission initiatives on open databases;
* Contribute to the further development of a common ontologies beyond the Industry Commons Ontology Commons EcoSystem (OCES)[[113]](#footnote-114) and the European Materials Modelling Ontology (EMMO); and
* Take into account the safe and sustainable by design framework and criteria for chemical and materials.[[114]](#footnote-115)

The network should consider facilitating the following cooperation areas:

* Modelling, including data- and physics-based materials modelling and AI-driven design
* Autonomous robotics platforms and fabrication technologies
* Characterization, including multi-scale, multi-technique, in/on-line
* AI-based data handling and workflow optimization
* Materials knowledge representation using semantic technologies

A training component to facilitate skills development, reskilling and upskilling should be included

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European and national initiatives, funding programmes and platforms. In particular, they should create links with the Data Spaces support centre funded under the Digital Europe programme, and work in close collaboration with the emerging Common European data spaces in order to ensure interoperability and coordination of data architectures. Interoperability for data sharing should be addressed.

## **Improving the resilience of EU businesses, especially SMEs and Startups**

**HORIZON-CL4-2024-RESILIENCE-01-41: 'Innovate to transform' support for SME's sustainability transition (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 10 million. |
| *Type of Action* | Coordination and Support Actions |
| *Eligibility conditions* | The conditions are described in General Annex B. The following exceptions apply:  The following additional eligibility criteria apply: In order to achieve the expected objectives and/or the specific policy requirements of the topic, the consortium must include at least three entities from at least three Member States or Associated Countries.  The following additional eligibility criteria apply: For actions funded under this topic, the same legal entity may only be the coordinator of one action. This means that any legal entity that is the coordinator of the consortium may receive only one grant under this topic. In case the same legal entity is the coordinator in more than one proposal submitted under this topic, only the last submitted proposal will be considered for evaluation. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exceptions apply:  Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 50 000. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Support objectives of the European Green Deal and of the EU SME Strategy for a sustainable and digital Europe;
* Increased resilience of SMEs, by fostering technological and social innovation in SMEs to support their transition to more sustainable business models and more resource-efficient and circular processes and infrastructures;
* Increased competitive sustainability of SMEs through the uptake of advanced technologies;
* Stronger innovation support ecosystems supporting the green, social and economic transition of SMEs, by leveraging synergies between existing EU networks and SME support initiatives.

Scope: Achieving European Green Deal objectives, and notably a climate neutral and resource efficient economy, requires the full mobilisation of SMEs. The COVID-19 pandemic has also led to companies redesigning their supply chains and facing a new industrial revolution, brought on by a new generation of advanced technologies[[115]](#footnote-116), which are underpinning the potential for competitive sustainability of SMEs.

The action will build on and further connect existing EU specialised business support networks and centres – such as the Enterprise Europe Network, the European industry clusters registered under the European Cluster Collaboration Platform, Centres for Advanced Technologies for Industry. They will work in complementarity and close interaction with Open Innovation Test beds, European Digital Innovation Hubs, Start-up Europe etc., but also with academia, social partners and other social innovation actors.

This action will consist in:

**A. Advisory services**

Dedicated innovation and capacity building support will be provided to SMEs, to assess their ability to transform their business models and increase their resilience.

This will consist of an assessment of SMEs’ innovation and sustainability practices, elaboration of recommendations, notably in view of the uptake of advanced technologies and/or social innovations.

Based on these recommendations, SMEs could receive further advisory services according to their level of preparedness such as help and advice on proof of concept, investment readiness, intellectual property (in cooperation with EU funded IP support)[[116]](#footnote-117), technology transfer, adaptation to standards, adaptation to environmental rules, design management, skill development, partner search (including social partners). SMEs will receive targeted assistance for the uptake of advanced technologies.

Social innovation should be recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

This action will also include the set-up of a community, building on the SME Alliance projects, in which best practices should be exchanged and SMEs could benefit from dedicated peer-learning activities in order to learn from leaders (SMEs or larger corporates) of their own sector. Incentives for leaders to share their best practices with peers should be identified in the context of EU support to industrial ecosystems.

**B. Financial support in the form of ‘Third party financing’**

As a result of the advisory services and initial assessments, SMEs will receive financial support through calls for SMEs, to implement the elaborated recommendations.

This should support amongst other activities the financing of a feasibility study, prototyping, pilot testing, demonstrating, procurement of further specialised consultancy services and coaching services that cannot be provided directly by the project partners, adaptation of business processes, free access and support to use testing facilities, introduction of new IT solutions etc.

The Commission estimates that at least half of the budget should be allocated to financial support to SMEs in the form of third party financing.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

**HORIZON-CL4-2023-RESILIENCE-01-42: Boosting generation and diffusion of advanced technologies in SMEs based on a supply chain model (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 2 and 3 million per each industrial ecosystem would allow these outcomes to be addressed appropriately. In total 4 projects are envisaged to be financed. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 10 million. |
| *Type of Action* | Coordination and Support Action |

Expected Outcome: Projects are expected to contribute to the following outcomes:

1. Build a model for each industrial ecosystem to identify disruptions and technological opportunities for the uptake of advanced technologies in a supply chain
2. Alert on current disruptions and identify potential future disruptions
3. Identify potential alternate suppliers of critical advanced technologies
4. Launch one pilot project per each industrial ecosystem focused on building alliances among traditional and tech-savvy SMEs through industrial cluster organisations
5. Explore concrete collaboration opportunities between different type of EU businesses, particularly tech-savvy SMEs and traditional SMEs.
6. Increase the adoption of advanced technologies in traditional SMEs and help EU tech-savvy SMEs that developed critical technology applications to expand their market potential in the EU;

Scope:

All the EU industrial ecosystems should adapt to the post-crisis economic environment, with new consumer and industrial demand, changed competition and new resilience and sustainability objectives. This adaptation will be particularly challenging for SMEs. The economic recovery in Europe, after the COVID-19 pandemic, will only materialise if SMEs are properly supported by adequate actions and policy measures to adapt to changed value-chains and demand.

It is essential for companies to map their supply chain in order to identify critical dependencies and weaknesses in specific industrial ecosystem. There is a need for developing methodology or model that can assist companies in detecting and anticipating disruptions in their supply chains. Such a model would contribute to reduce strategic dependencies on critical products, services or technologies.

The operational independence that the manufacturing industry will be achieved through the adoption of advanced technologies. This operational improvement will be of paramount importance in ensuring performance during the next normal. In fact, COVID-19's impact on trade caught many firms unprepared, with negative consequences on supply chains. This event drastically changed the focus from a low-cost country sourcing mantra to a more resilient and simpler network. Implementing new technologies is turning supply chain processes and activities towards less uncertainty and complexity. Technologies like robotics, AI, IoT, blockchain, and edge computing are the key drivers to achieve these goals, together with efficiency benefits and zero-touch production (ZTP) processes, the latter being pushed significantly during the pandemic and becoming a strategic asset for the future of enterprises.

Efficiency is also fostered by AR/VR solutions, which enable experts to provide remote support to on-field operators and provide step-by-step instructions. B2B digital platforms are also a key trend in the manufacturing industry, pushing for a more collaborative relation between colleagues, peers, and employees. This opportunity is deeply connected to Big Data/analytics technology, which allows the user to track and analyse processes, improve operational visibility, and understand improvements and trends. 3D printing has shown its huge potential in creating and modifying manufacturing and healthcare products during the pandemic and is likely to be a key trend in the coming years. Product innovation is also driving the adoption of advanced materials, micro- and nanoelectronics, nanotechnologies, and photonics with the aims of improving products and reducing costs.

**HORIZON-CL4-2023-RESILIENCE-01-44: Affordable Housing District Demonstrator (IA)**

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution around EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 10 million. |
| Type of Action | Innovation Action |

Expected Outcome: Projects are expected to contribute to following outcomes:

1. **Demonstrate innovation in** **renovation or construction of social housing** districts to obtain replicable demonstrators or “*lighthouse affordable housing districts”* following the principles of the *Affordable Housing Initiative*[[117]](#footnote-118)and, more broadly, taking into account the values *and the New European Bauhaus[[118]](#footnote-119).* Demonstrators can contribute to a smart neighbourhood approach setting liveability of local communities and residents at the forefront.
2. Mobilise within the project a cross-sectoral industrial[[119]](#footnote-120) and multi-stakeholder partnerships at local level to develop, adapt, design new processes, methods or technologies on affordable housing (by developing one or more innovative strands), with a focus on SMEs active in the area of social housing construction, renovation and development. For example SMEs related to construction, energy efficiency, circular economy, modular building, smart living, eco-design, social housing service, etc.. Equally engaging other non SME stakeholders such as residents, social and public housing associations, civil society actors, public authorities will be key to boost tailor-made and fit for purpose innovation;
3. DDemonstrators should go the ‘extra mile’ and prove continuity in terms of a more integrated renovation Besidesor new build approach at district level by demonstrating **one or more innovative strand(s)**:
   1. **technological innovation** fostering liveability for local communities and residents, accessibility, access to (social) services, improving cohabitation amongst residents and interaction with social housing providers.
   2. **Social innovation,** addressing specific social challenges in housing districts and neighbourhoods. Examples could be models improving the wellbeing of promoteresidents, addressing basic needs and services, promote new forms of housing and housing organisation such as intergenerational and mixed forms of housing and accessible architecture open for cultural and creative innovation. Social innovation may also promote social business models fostering economic activity at district or neighbourhood level.

* regulatory limits, lack of trust amongst different stakeholders, lack of private investors and awareness of the integrated approach potential);
  1. **Innovative partnership and engagement models**: project, financial, investment and business models based on inclusivity and cooperation, as well as partnership models improving stakeholders’ involvement in the construction process. Examples could be cooperative models for housing and utilities (cooperative housing, community land trust), leveraging social engagement models to empower and engage residents, public private partnership and impact investment schemes, post renovation planning and spatial organisation allowing socio-economic regeneration of the district.
  2. **Green innovation**. Examples could be: resource efficiency, circular and environment friendly techniques during the construction process as well as facilities and interventions fostering the ecologic ambition of housing once the construction is completed (such as integration of green spaces, improvement of biodiversity, landscaping, water-, waste- and energy management, shared consumption models, clean mobility provision, green spaces, city agriculture, air quality, monitoring instruments,…) or linkages to the deployment of a Positive Energy District[[120]](#footnote-121).

Replicability of innovative solutions demonstrated by the project is important. To this extent, relevant indicators and metrics, with baseline values, should be stated clearly in the proposal.

capture and disseminate learnings and major innovation outcomes to support the implementation of industrial-urban symbiosis, connection to European communities of practices established by the *Affordable Housing Initiative* and the *New European Bauhaus* or other relevant initiatives such as the European Urban Agenda.

ultimate objective of the proposed action is to obtain a set of lighthouse affordable housing districts that each have followed a different approach, focussing on one or a combination of different innovative strands.

The proposed action supports the **New European Bauhaus** and **Affordable Housing Initiative**, as lighthouse districts should display the application of the New European Bauhaus practices focussing on co-creation with the affected populations as well as on their improved quality of experience (including in terms of aesthetic or cultural meaningfulness) resulting from the renovation and building of social housing districts.

Scope:

TIndustrial symbiosis needs to be fostered amongst most relevant partners engaged in construction and renovation of social housing facilities. The local and regional dimension is important since local energy and utility networks, adjacent industrial infrastructures and available by-products and services in such districts needs to be considered in a holistic and integrated approach.

TWhere appropriate, projects can address **COVID-19 related challenges and opportunities** such as reorganisation of housing areas and districts, conversion of office buildings into housing units, (inter)generational living, housing facilities addressing new work-life standards and needs, neighbourhoods driving local economic activity and new entrepreneurial opportunities, energy price shocks, increased material costs, etc.

When proposing the demonstrating district, projects are expected to address all following aspects:

* Identify districts that are "ready to go" or at least in an advanced planning stage allowing the integration of an “extra mile” effort in terms of one or more innovation strands.
* Generate results that are replicable for other districts. In this context ‘replicable’ is to be understood as: outcomes generated by the demonstrator projects’ implantation (for example, know-how, innovative solutions, proof of feasibility, new business models, adapted and scaled technology usage, policy recommendations, guidelines, prototypes, demonstrators, databases and datasets, trained researchers, new infrastructures, networks) should be directly usable or transferable for implementation after the project ends. Results should be appropriately documented to serve as guidance for actors in other territories outside the project interested in applying or adapting the solutions to their specific context.
* Plan actions for overcoming relevant barriers for renovation at district level (e.g. regulatory limits, lack of trust amongst different stakeholders, lack of private investors and awareness of the integrated approach potential);
* Guarantee a majority (+50%) of social housing dwellings including a dominant focus on affordability for the remaining dwellings.
* Ensure to prevent potential perverse effects are taken into account such as energy poverty, gentrification effect, creaming and *'renovictions'* or ‘*ghettoisation’* and make sure resident engagement is embedded.

In terms of project design and methodology, proposals should include:

* The development of an ambitious, mission-oriented, quality co-design process, based on citizens’ and stakeholders' participation and multidisciplinary and multilevel collaboration
* An ambitious and credible executive plan that identifies and analyses the challenges and resources of a given territory (e.g. neighbourhood, district, ecosystem) in terms of sustainability (in line with the European Green Deal), inclusiveness (including social cohesion, accessibility and affordability) and aesthetics (including functionality, comfort, attractiveness, etc.).
* Deployment of an initial set of solutions as demonstrators within a two-year timeframe, accompanied by a rigorous impact evaluation methodology. Involvement in the testing of the innovation actions within the demonstrators with international experts.
* A detailed roadmap for implementation, with a sustainable financial plan identifying potential and substantial additional investment based on involvement and partnerships with different actors (national, regional, local, public and private sources).

Projects are expected to participate in European-level networking opportunities in the context of the NEB and Affordable Housing Initiative.

To ensure a balanced portfolio covering geographical areas, grants will be awarded to applications not only in the order of ranking but at least also to the projects that are the highest ranked covering different parts of the territory of the European Union and Associated Countries, provided that the applications attain all thresholds.

# **Destination: World-leading Data and Computing Technologies**

## **Data sharing and analytics capacity**

HORIZON-CL4-2024-DATA-01-01: AI-driven data operations and compliance technologies (AI, data and robotics partnership) (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 8 and 10 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [36 – 40] million. |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* To enable companies and public sector to easily comply with existing and emerging regulation (e.g. GDPR, Data Governance Act, Data Act, AI Act) and create value on data assets that they possess or that they acquire from the market, and to allow citizens to feel more confident that data-driven systems treat them in a fair, unbiased and compliant way and respect their privacy/anonymity and other rights, and keep track of the use of personal data in a world where “everything” moves online.
* Shorten the time-to-market and reduce development costs of compliant data solutions
* Quantify and reduce the environmental footprint of data operations which will contribute to the Green Deal target “no net emissions of greenhouse gases by 2050”.

Scope:

Developing, piloting and integrating systems, compliance tools and data economy enablers that process the increasing data volumes more efficiently, distil more useful knowledge from data, and contribute to the measurement, labelling, certification and reduction of the environmental footprint of massive data operations (e.g. by minimizing data transfers/traffic and/or reducing energy consumption of AI training/machine learning, privacy preservation and other processes).

The technologies should respond to the emerging needs for practical, affordable and automated compliance tools (e.g. privacy preservation, smart contracting, consent management, tracking of uses of data etc.), as well as design principles and architectures that are inherently compliant, addressing the relevant cybersecurity issues.

The aim is to provide Common European data spaces and AI data provision with reliable mechanisms to monitor, control and track/record transactions on data, to ensure compliance.

To this end, projects are invited to employ appropriate technologies and methods, such as federated and distributed AI/analytics; protect privacy and confidentiality of AI training data and reduce energy footprint.

Proposed actions should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. In particular, they should build on the results of the Horizon 2020 data platform projects (topic ICT-13-2019) and the results of projects selected under topic HORIZON-CL4-2021-DATA-01-01, as well as the projects to be selected under topic HORIZON-CL4-2023-HUMAN-01-01.

This topic implements the co-programmed European Partnership on AI, data and robotics.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-DATA-01-02: Integration of data life cycle, architectures and standards for complex data cycles and/or human factors, language (AI, data and robotics partnership) (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of 9 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [43-47] million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* ability to process vast volumes data as one of the key enablers for other technological developments, supporting the competitiveness of the EU’s industrial ecosystems;
* successful deployment of data spaces involving several sectors of economy or society;
* improve data access (in line with the FAIR[[121]](#footnote-122) principles), data sovereignty, data interoperability and data protection as an essential factor in the development of sustainable value chains respecting all stakeholder interests, particularly SMEs, but also the public sector as data providers and innovation/market ecosystem enablers. The Data Strategy for Europe calls for actions to support and promote data sharing and the use of data for social and economic benefit.

Scope:

Proposals should address the entire data life cycle from data generation/collection to the final use and disposal/deletion of data (especially when required by applicable legislation, for example GDPR). Proposals should build on existing and emerging standards, models and architectures and complement/expand them as necessary in view of interoperability of systems and portability of data, especially between sectors, between private and public sectors and between different communities/constituencies of actors, including consideration of cybersecurity issues and analysing the use and re-use potential, especially in view of use of data across sectors. Envisaged architectures and systems should enable correct allocation and enforcement of data-related rights, obligations and responsibilities across the life cycle. Proposals should address relevant human language issues at all stages of data life cycle, addressing the social and cultural factors as necessary. Systems and approaches should be able to process human-generated and human-related data (e.g. speech, text, images) and put data into context (including cultural, linguistic and social context). Likewise, the seamless integration of “human in the loop” (whenever full automation is not possible/desirable) should be considered and implemented where applicable.

Proposed actions should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. Based on an analysis of cross-fertilisation potential of data re-use, the proposal should include use cases or pilots addressing or involving at least three different common European Data spaces and/or related ecosystems. In particular, they should create links with the Data Spaces support centre funded under the Digital Europe programme, and work in close collaboration with the emerging Common European data spaces in order to ensure interoperability and coordination of data architectures. Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

This topic implements the co-programmed European Partnership on AI, data and robotics.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

## **From Cloud to Edge to IoT for European Data**

In line with Europe’s data, green and industrial strategies, for capitalising on the paradigm shift to the edge, Europe needs to pool major investments. Considering the exponential growth of connected devices and systems, data processing and analytics at the edge will become an engine for industrial transformation in key sectors. Building on Europe’s industrial leadership in many sectors and in particular in the industrial Internet of Things, this trend offers the opportunity for European actors to establish a computing infrastructure which does not replace the cloud but which could strive for innovation and openness, different from today’s cloud and data processing market. Harnessing the massive increase in chips production in Europe, Internet of Things and edge computing becomes one of the key driver for the chip demand in terms of next generation industrial computing fabric and system design, on-site factory edge, or integration of renewables at the grid edge.

WP2023-24 targets the validation of these new paradigms, it will be on the development and adoption of baseline technologies and system concepts integrating relevant elements of computing, connectivity, IoT, AI cybersecurity. These were supported under WP 2021/22 in order to reach the next maturity stage towards further deployment. The next WP will build on European strengths in real-time systems, sensors, (industrial) IoT, system engineering, and industrial application and supports the realisation of a European computing continuum value chain from Cloud-to-Edge-to-IoT in and across key industrial sectors like mobility, logistics, energy, agriculture manufacturing.

HORIZON-CL4-2024-DATA-01-03: Piloting emerging Smart IoT Platforms and decentralized intelligence (IA)

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| **Specific conditions** | | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR [ 20– 25 ] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is EUR [42-48] million. | |
| *Type of Action* | Innovation Action | |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Financial Support to Third Parties* | | Beneficiaries may provide financial support to third parties up to 20%. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 200 000 in order to allow third parties to support industry, in particular SMEs, in take-up of emerging edge topologies, for populating and validating relevant use cases through experiments. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  “To ensure a balanced portfolio covering as many strategic sectors as possible, grants will be awarded to proposal not only in order of ranking but also to achieve broadest coverage of the following sectors, strategic for European competitiveness: industrial automation, renewable energy, electro-mobility, and farming, and which are not covered by higher-ranked proposals, provided that the proposals attain all thresholds. | |
| Link with other topics in other WPs | KDT JU | |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Implementations of edge paradigms in real environments leading to matured and customised IoT and next generation edge computing technologies for adoption in key applications and sectors.
* Paving the way to strategic industrial cooperation in data processing required to support future hyper-distributed applications by building open platforms, agreement on common architectures and standards, critical to establishing a mature European supply chain.
* Open platforms underpinning an emerging open edge ecosystem including midcaps, SMEs and start-ups that foster edge solutions, which represent a modular functional spectrum of executable apps and services critical to establishing a mature European supply chain under challenging and extremely competitive market conditions.
* Demonstrating cross-domain standardisation and up-scaling of edge infrastructure solutions

Scope:

Proposals should target up-take and up-scaling of emerging EU-driven smart industrial internet of things and edge computing systems to perform under real life conditions, as to mature particular technologies like meta-operating systems for the IoT and the Edge, cognitive cloud technologies and tools for decentralized intelligence and swarm computing for adoption across key applications and sectors crucial for Europe’s competitiveness and strategic autonomy.

Such systems must be targeted in order to create value in orchestrating multi-tiered data processing with control and automation on the edge, minimizing energy footprint, stimulating multi-sided marketplaces, and fostering open standards for virtualization, interoperability and secure and trusted data sharing between different stakeholders of the value chain – both horizontally and vertically, thereby providing an environment of multi-platform capabilities and preventing lock-in effects for users. Pilots are to implement and demonstrate mature solutions, on technology integration such as sensors, actuators, distributed control, connectivity and edge computing and embedded reasoning to demonstrate security, resilience and autonomy of system with low data processing latency for analytics and AI-inference and decentralised intelligence at the edge. In order to avoid concurrent solutions and fragmented standards and tools, pilots should validate cross-domain interfaces and common standards and foster cross-sector industrial agreements on architectures, design tools and governance. With the cross-domain up-take these pilots will demonstrate shorter development circles, accelerate adoption of edge infrastructure through shared cross-domain usage, especially through the creation of common management tools and standardised edge architectures

The objective is the development of systems to become open platforms underpinning an emerging open edge ecosystem including midcaps, SMEs and start-ups that foster edge solutions, which represent a modular functional spectrum of executable apps and services critical to establishing a mature European supply chain under challenging and extremely competitive market conditions

Innovation Actions are used to customise, explore the limits, test, optimise and validate emerging European smart IoT and edge computing systems under the constraints of industrial mass-market applications, by taking a system-level approach from hardware of smart devices to operating systems at device and at system level, to middleware and to application software. Pilots are expected to address cross-sector platforms in more than one application domain, which are strategic for European competitiveness such as industrial automation, condition-monitoring/predictive maintenance and logistics, renewable energy, buildings and electro-mobility, farming and telecom edge cloud business applications, or others.

Pilot projects will contribute to the coherence/cluster work that will be implemented by the CSA called under WP2024-DATA-01-05, supporting the activities defined under ""Horizontal Activities"" below. This requires that they contribute to clustering their results of horizontal nature (interoperability approach, standards, security and governance approaches, validation of emerging business models for an emerging IoT/edge infrastructure and sustainability, methodologies, metrics, etc.). Links to RRF investments towards the next wave of modernization of European infrastructure should be explored.

Multidisciplinary research activities should address all the following aspects:

* Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.
* Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.
* Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms such as KDT JU, GAIA-X, ….

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement

HORIZON-CL4-2023-DATA-01-04: Cognitive Computing Continuum: Intelligence and automation for more efficient data processing (AI, data and robotics partnership) (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 4.00 and 6.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [27 -29 ]million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| Link with other topics in other WPs | Projects are expected to develop synergies and relate to activities and outcomes of the Digital Programme and any existing or emerging IPCEI initiatives.  Cluster 3 - HORIZON-CL3-2023-CS-01-01: Secure distributed platforms (IoT, Edge, Cloud, Dataspaces) and HORIZON-CL3-2023-CS-01-02: Privacy-preserving and identity technologies |
| International Cooperation | In line with the Union’s strategy for international cooperation in research and innovation with like-minded countries in areas of mutual interest, and in order to achieve the expected outcomes, international cooperation is encouraged, in particular with Japan and South. Korea. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Enhanced openness and strategic autonomy in the evolving data and AI-economies across the computing continuum including adapted system integration at the edge and at device level, validation of key sectors and nurturing European value chains to accelerate and steer the digital and green transitions.
* Paving the way to strategic industrial cooperation in data processing required to support future hyper-distributed applications by building open platforms, underpinning an emerging industrial open edge ecosystem critical to establishing a mature European supply chain.
* Establishment of adaptive hybrid computing, cognitive clouds and edge intelligence beyond today’s investments on data infrastructure.
* Better international collaboration with trusted partner regions, guaranteeing a minimum level of interoperability, portability thereby fostering competition in the Cloud/Edge services market for the European cloud/edge and software industry and facilitate European access to foreign markets.

Scope:

The Cloud-Edge Continuum must provide seamless management schemes to allow services and data to be processed across various providers, connectivity types and network zones. This requires innovative management techniques and computational methods of the whole computing continuum from Cloud to Edge to IoT that are enabled by Swarm computing and decentralised intelligence.

It involves hyper-distributed computing approaches encompassing resources from IoT and far-edge constrained devices, to federated fog/edge computing nodes to central cloud computing centres and hybrid cloud models which exploit Artificial Intelligence techniques to advance automation and dynamic adaptation of resource management in Cloud and Edge systems, and thus intelligently balance computing tasks across decentral and central computing environments to optimize resources and quality of service.

Focus must be on autonomous and AI-enabled management schemes and data processing methods that enable this transition to a compute continuum with strong capacities at the edge and fog/IoT edge in an energy efficient and trustworthy manner. Intelligent compute, data and code orchestration mechanisms need to integrated, which allow efficient value extraction from the huge volumes of generated data at the edge of the network and which support unprecedented levels of resource dynamicity and scalability across the compute continuum.

Concept should cater for novel automated management tools, programming models, learning and decision-making methods, and approaches able to cope with end-to-end security and identity management, resources heterogeneity, extreme scale and fault-tolerance together with elasticity to flexibly allocate resources and tasks. For learning, methods need to be able to deliver a solution to (continuous) federated learning from data distributed over the edge and in the network. For security and identity management, proposals are expected to apply state-of-the-art technologies, develop synergies and relate to activities and outcomes in Cluster 3 (namely, HORIZON-CL3-2023-CS-01-01: Secure distributed platforms (IoT, Edge, Cloud, Dataspaces) and HORIZON-CL3-2023-CS-01-02: Privacy-preserving and identity technologies).

Resource heterogeneity should consider the diversity of devices equipped with storage and processing capacities at the Edge and their specific characteristics (e.g., resource‐constrained devices), but also the increasingly available variety of processor architectures for these devices, including where possible, emerging open solutions (e.g. RISC-V).

Novel approaches are needed to support distributed machine learning and decision-making by providing the right balance between centralized and decentralized solutions to maximize the energy efficiency, resilience and effectiveness of the system while increasing privacy and interaction between different organizations without explicit sharing of data.

In addition, it should incorporate tools and mechanisms enabling the optimisation of energy efficiency and ecological sustainability taking into account end-to- end data processing across the continuum. Interoperability approaches (based on open standards, interoperability models and open platforms) should be considered where appropriate.

Projects are expected to develop synergies and relate to activities and outcomes of the Digital Europe Programme (DEP) and any existing or emerging IPCEI initiative.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

International cooperation is encouraged, especially with Japan and S. Korea.

This topic implements the co-programmed European Partnership on AI, data and robotics.

HORIZON-CL4-2024-DATA-01-05: Platform Building, standardisation and Up-scaling of the ‘Cloud-Edge-IoT’ Solutions (Horizontal Activities - CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around 2 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2 million. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| Link with other topics in other WPs | KDT JU – explore linked to INSIDE and EPOSS especially on Cyber Physical Systems and Smart Systems Integration |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Supporting the Commission and the constituency in coordinating the proposal portfolio in particular resulting from HORIZON-CL4-2024-DATA-03, and ensure consistent exploitation of the outcomes.
* Alignment with national or regional initiatives will create an expanding innovation eco-system, anchored in local contexts across Europe.
* Underpinning an emerging open edge ecosystem including midcaps, SMEs and start-ups, critical to establishing a mature European supply chain
* Outcomes are expected to accelerate the pick-up of novel advanced edge technology in most important sectors for Europe’s economy, and competitiveness as well as an analysis of cross cutting aspects like open standards, open source frameworks, data compliance, security as well as synergies across sectors.

Scope:

CSA actions provide consistency and linkages between the pilots and complement them by addressing horizontal challenges critically important for the take-up of edge computing at the anticipated scale. Support programme implementation across projects and topics in the area of Cloud-Edge-IoT, especially foster consensus on interoperability and standards as well as ecosystem building in and across verticals, an environmental and green impact. The CSA will ensure an efficient interplay of the various elements of computing, network connectivity, AI and learning, etc. establish a concept through a forum to link to relevant European and national initiatives and partnerships like KDT JU and add value by active cross-fertilisation across academia and industry and sectors, . A fertile communication strategy for broader stakeholder engagement is expected. Concrete activities will include trend scouting, portfolio analysis, a variety of participatory workshops, analysis of emerging business cases, accelerator of technology up-take and promotion of open calls, especially for SMEs and midcaps.

Better international collaboration with trusted partner regions, guaranteeing a minimum level of interoperability, portability thereby fostering competition in the Cloud/Edge services market for the European cloud/edge and software industry and facilitate European access to foreign markets

Multidisciplinary research activities should address all of the following issues:

* Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in relation to privacy preservation and security at the edge.
* Activities should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.
* Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement

HORIZON-CL4-2023-DATA-01-06: Coordination and Support of Cognitive Computing Continuum research and policy (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 2.0 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2 million. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| Link with other topics in other WPs | Important Project of Common European Interest on Cloud Infrastructure and Services (IPCEI CIS) |
| International Cooperation | International cooperation In order to achieve the expected outcomes international cooperation is encouraged, especially with Japan and S. Korea. |

Expected Outcome: Proposal results are expected to contribute to the following expected outcomes:

1. Support structure for the European Computing ecosystem: networking events and vision workshops for the academic and industrial computing community,
2. Yearly updated roadmaps on the computing continuum addressing the area from a broad perspective from edge device to edge cloud to cloud to HPC, from scientific to industrial to societal and research applications, and addressing all relevant aspects such as real-time, security, etc. Developments should complement the Industrial Roadmap from the European Alliance for Industrial Data, Edge and Cloud by offering a long-term research perspective which enables disruptive innovations.
3. Creation of a sustainable European forum of stakeholders representing the whole Cloud to Edge to IoT Computing research, industry and users.

Scope:

To support the European Commission and the European computing constituency by providing to them annually updated roadmaps for research and innovation.

* To seek collaboration with other relevant initiatives in the field, such as those related to the Important Project of Common European Interest on Cloud Infrastructure and Services (IPCEI CIS) and the European Alliance for Industrial Data, Edge and Cloud..

To facilitate awareness of stakeholders in research and policy matters related to Cloud-Edge-IoT Computing continuum.

To coordinate stakeholders in the Cloud to Edge to IoT Computing Continuum and act as support to R&D programmes/activities by disseminating project results and organising scientific and policy events, and addressing pre-standardisation initiatives.

International cooperation is encouraged, especially with Japan, South Korea.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

# **Destination: Digital & Emerging Technologies for Competitiveness and Fit for the Green Deal**

## **Open Source for Cloud/Edge and Software Engineering Fundamentals to support Digital Autonomy**

HORIZON-CL4-2024-DIGITAL-EMERGING-01-01: Open Source for Cloud/Edge and Software Engineering to support European Digital Autonomy (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 4.00 and 6.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [19-21] million. |
| *Type of Action* | Research and Innovation Action |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio, at least one proposal per subtopic will be selected provided that quality of proposals does allow for that. |
| *Technology Readiness Level* | Activities are expected to start at TRL 4 and achieve TRL 7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| Link with other topics in other WPs | This topic will foster the ability to deploy computing hardware based on European processors for cloud and edge server systems exploiting efficiently multi-architecture capabilities. It contributes to the strategic objective of building and reinforcing EU capacity by turning into manufactured products the reinforced capacity targeted by the Chips Act. Projects are expected to develop synergies and relate to activities and outcomes of the KDT/Chips and the EuroHPC Joint Undertakings, the European Processor Initiative and the European RISC-V working group. |
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Expected Outcome: Projects are expected to contribute to the following outcomes:

1. Prototypes of cloud and edge servers demonstrated in relevant centralised and distributed environments and allowing full computing infrastructure deployments based on European processor technology, thereby establishing a full Open Computing Architecture stack, which supports emerging processing architectures (e.g. RISC-V).
2. Software engineering methods and tools leveraging AI to accelerate the development and maintenance of the European open computing architecture, addressing, among others, the efficient and agile development, verification, validation, maintenance, vulnerability assessment and mitigation for multi-core multi-architecture systems.
3. New standards and best practices for engineering future software systems, as well as adapting current systems to future challenges.

Scope: Proposals should address one of the following two subtopics

* Facilitate the emergence of a full **European Open Cloud and Edge Computing Architecture** by
  + Developing open source alternatives to enable the physical use of emerging processors in cloud and edge server systems, and interfacing with relevant industry standards. Such modules include basic input/output systems, pre-boot execution environments, power-on authentication, etc., supporting heterogeneous processor architectures.
  + Demonstrating actual cloud and edge systems in real life or emulated computing environments exploiting the benefits of an extended open source stack (socket to application) on emerging processor architectures (e.g. RISC-V).
* **Fundamentals of Software Engineering supporting the European cloud and edge ecosystem:** Develop open source libraries, protocols, methods and tools to foster agile development:
  + Advanced software for virtualised and/or heterogeneous multi-core multi-ISA (Instruction Set Architecture) including automatic cross-compilation and binary multi-architecture executables, and cost-effective methods and practices for development, verification, validation, and maintenance of extremely advanced and sophisticated multi-architecture software systems.
  + Innovative software development tools based on AI allowing smart and intelligent code analysis and emulation to automate and bring unprecedented productivity, preventing bugs, errors and vulnerabilities before testing the real system.
  + Design and simulation/emulation tools for open source high-level system modules, e.g. electronic design automation tools.

Research should interface with relevant existing standards and contribute to standardisation where appropriate.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. In particular, work under this topic should complement the development of European HW and related low-level software as done under the KDT and EuroHPC JUs, to make these exploitable for cloud and edge servers.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-02: Public recognition scheme for Open Source (CSA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 2 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2 millions. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| Link with other topics in other WPs | Important Project of Common European Interest on Cloud Infrastructure and Services (IPCEI CIS) |
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Expected Outcome: Projects are expected to contribute to the following outcomes:

1. Establishment of a system of European annual awards that acts as a spotlight stirring up contributions to Open Source Software and Hardware projects.
2. Increased interest for the contribution to, integration of and exploitation of Open Source assets

Scope: The action should first develop a scheme including a list of fields related to Open Source. An indicative but non-exhaustive nor obligatory list of topics could include deep contributions to kernel code, brilliant utilization of open source in companies’ new developments. The action should elaborate an adequate process to

* scrutinize different fields of action relevant to open source
* select appropriate candidates for being recognised
* implement adequate award ceremonies

Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in sociology and human behaviour, to achieve a wider interest in the efficient exploitation of available open source assets.

Proposals submitted under this topic should include an exploitation strategy, as outlined in the introduction to this Destination, which allows recurrent awards.

Additionally, a strategy for skills development should be presented, associating social partners when relevant.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement

## **European Innovation Leadership in Photonics**

HORIZON-CL4-2023-DIGITAL-EMERGING-01-51:   
Pervasive photonics - multi-technology integration for digital infrastructure, sensors and internet of things (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [17-19] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Gender dimension* | In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement |

**Expected Outcome**: Projects are expected to contribute to the following outcomes:

1. Improved key metrics for communications (speed, power consumption, density), making photonics ubiquitous in digital systems
2. New photonic-enabled sensing functions and computing paradigms or architectures, not feasible with single technology, enabling new systems architectures (e.g. neuromorphic computing)
3. Vital contribution to Technological Sovereignty, Green Deal, Digital Transformation and Competitiveness, enabling new functionality, higher performance, more cost-effective systems across multiple application domains
4. Market expectations follow and will accelerate overall trends for digital systems (computing and communications), autonomous systems, Internet of Things
5. Enables strong European position to be maintained in the face of strong global competition

**Scope**:

Proposals should address the following:

1. Co-integration of photonics and microelectronics on single or multiple die (‘chiplet’ approach)
2. Co-integration of multiple photonic IC technologies to address new wavelengths and sensor functions
3. Applications in computing, communications, robotic and autonomous systems, sensors, Internet of Things

This topic implements the co-programmed European Partnership Photonics.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-52:  
Advanced imaging and sensing technologies (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 5 and 7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [19-21] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Gender dimension* | In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement |

**Expected Outcome**:

Projects are expected to contribute to the following outcomes:

* The development of next generations sensory systems based on photonic technologies
* Technology leadership in autonomous vehicles, robots and sensory systems; Growth in a number of strategic industries such as medical devices, automotive, manufacturing, agriculture & food, security of large added value which are in Europe.
* Contribution to the Digital Green deal policy and/or to the technological sovereignty of Europe.

**Scope**:

Innovative hardware and software approaches, or to explore novel techniques with potential to outperform the current standards.

The projects will demonstrate the technology in the form of complete function (or building blocks) showing feasibility for future industrialisation.

It will address the following sectors:

* Automotive, where detection of pedestrians, obstacles and other vehicles at long distance is required in order to safely prepare the reaction of the vehicle in all weather conditions;
* Defence and security, where fast reconnaissance and identification of collaborative or non-collaborative targets is required for defence missions and surveillance of infrastructures;
* Industry, where long-range imaging can be used for logistics and inspection and analysis of safety and quality control of processes or produced goods;
* Health, where non-invasive spectroscopic and biophotonic imaging techniques enable diagnosis, screening, monitoring and treatment of a patient, preferably with augmented reality (AR) visualization;
* Agriculture and food, where spectroscopic imaging enables non-destructive measurement/monitoring of plants and crops and plant nutrients during production and post-harvest (e.g., phenotyping); this allows fast interactions/adjustments and enables monitoring of plant materials and food products along the entire production chain for quality and safety aspects.

Technologies covering more than one application sectors above would be encouraged, such as:

* Long range, high speed, eye-safe imaging for automotive, defence, and industrial systems
* Imaging in presence of obscurants for medical, automotive, manufacturing, agriculture, food and security, spectroscopic imaging for medical, environmental, agriculture, food monitoring and defence.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-53:   
Versatile light sources and systems as tools for manufacturing and medical application (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [17-19] million. |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Gender dimension* | In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement |

**Expected Outcome**: Projects are expected to contribute to at least one of the following outcomes:

* Outcome 1: Increased manufacturing productivity;
* Outcome 2: Increased accuracy and reduced feature size in microelectronics production for the integration of photonic and electronic functionalities on chips;
* Outcome 3: Increased specificity of diagnosis of human tissue and specific single cells.

**Scope**:

Proposals should address new versatile light sources and lasers, concept and systems for extended and new fields of applications. Research challenges include:

* Sources with multi-specification / multi-application potential;
* Extended or new wavelength ranges, novel coherent sources;
* Flexible and variable energy deposition (e.g. material processing, medical diagnosis) ;
* Versatility by spectral tuneability, coherence and multi-wavelength emission;
* Versatility by flexible pulse shapes, repetition rates and intensities (cw down to fs and bursts);
* Laser concepts and systems for multiphoton microscopy, spectroscopy and imaging.

The results and benefits of the developed technologies should be demonstrated in at least two realistic use cases.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

This topic implements the co-programmed European Partnership Photonics.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-54:   
Smart photonics for joint communication & sensing and access everywhere (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [17-19] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Gender dimension* | In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement |

**Expected Outcome**: Projects are expected to contribute to the following outcomes:

1. Sensors/probes to monitor the quality of the communication network and of photonic signals transported in the communication network
2. Methods to use the network as large-scale distributed sensor
3. Development of foundational optical technologies, systems and networks that provide the future access infrastructure

**Scope**:

Proposals should address the following:

1. Light-based solutions to let the communication network sense, while transporting data:

* To enhance the security and resilience of the network
* To make network resources more energy efficient
* To warn and protect against natural disasters, earthquakes etc.
* To monitor the infrastructure where the fibre is deployed (traffic, stress in bridges…)

1. Light-based solutions to bring internet everywhere, with the most relevant access technologies

* Fiber to the home, fiber to the antenna, fiber to the sky (satellite) for ecxample with coherent passive optical networks, free space optics, Lifi, optical beamforming and steering
* while enabling the integration of all access technologies in one system

This topic implements the co-programmed European Partnership Photonics.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-55:   
Photonics Innovation Factory for Europe (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of up to 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [14-16] million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 8 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Gender dimension* | In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement |

**Projects are expected to contribute to the following outcomes:**

* Substantially improved penetration of core photonics technologies into multiple end-user application domains and industry sectors, in particular through carefully selected SMEs and new start-ups with the strongest potential for high impact in terms of business growth and employment, enabling a demonstrably more competitive and technologically sovereign European industry.
* Creation of a sustainable streamlined ecosystem for photonics innovation in Europe from TRL3-8, providing European Cross-Border Added Value with a high leveraging effect on investments made at national and regional level in photonics.

**Scope**:

The aim is to provide a virtual factory with a flexible and open structure, allowing for a multiplicity of competitive actors and services operating as a sustainable fully integrated European ecosystem of cross-border deep innovation support in core photonics technologies for the benefit of European industry. The factory should lower the entry threshold to photonics and facilitate the broad uptake and integration of these technologies in new products and processes with high potential impact in the market and on society.

Help speed up the deployment of proven photonics technologies within European industry in order to increase its global competitiveness, with an emphasis on technological sovereignty and resilience while also fostering strong new enterprise business growth.

**Proposals should address the following**:

A streamlined virtual access, supported through a network of competence centers acting as a single consortium, to a supply chain offering the broadest range of photonics technologies that cover the entire photonics innovation spectrum from concept to commercialization (TRL3-8).

The action should create pathways from initial concept through to production, employing scalable manufacturing methods connected to pilot lines and pre-series production facilities appropriate to the market, and thereby closing the gaps in photonics value chains and unlocking investments in European manufacturing based on more complete and mature solutions.

The action needs to target primarily first users and early adopters enabling the wider uptake and deployment of core photonic technologies in innovative products and processes with strong commercial potential.

Support cases must be innovative and industrially relevant, requiring intensive cross-border collaborative expert intervention to overcome specific innovation challenges based on synergetic photonics core technologies, and should include business-related coaching activities directly linked to the innovation activities to support industrialization steps to full commercial launch as a complete value chain appropriate to the market needs.

The action must build on relevant previous European initiatives and existing infrastructure at European and regional levels, use a proven Quality Management and Impact Measurement Framework for the direct innovation support interventions, demonstrate a record of accomplishment in supporting industry, in particular SMEs and start-ups, with deep cross-border innovation support.

The action should provide strong linkages with established European Photonics industry and investment networks such as the Enterprise Europe Network, as well as (pan-) European Digital Innovation Hubs and cluster organizations in both the photonics and photonics-enabled application domains.

The action should address innovation-readiness support in the form of Demonstration Centers and Experience Centers to help prepare business cases plus additional supports such as technology, business, investment, and intellectual property coaching aimed at maximizing the potential future commercial impacts from the innovation support activities. The action must also be capable of demonstrating a strong business plan towards durable funding and sustainability of its activities.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-56:   
Photonic Strategies and Skills Development (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution up to 1 million per dimension would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 3 million. |
| *Type of Action* | Coordination and Support Action |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Gender dimension* | In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement |

**Expected Outcome**: Projects are expected to contribute to the following outcomes:

1. Reinforced value chains and deployment of photonics technologies by stronger cooperation of photonics stakeholders, clusters and end-users (sub-topic 1);
2. Increased competitiveness of the European photonics sector and improved access to finance for the photonics sector in Europe (subtopic 1);
3. More and better prepared professionals in the photonics sector (subtopic 2).

**Scope**:

Proposals should address one of the following dimensions:

**Supporting the industrial strategy for photonics in Europe**: the objective is to support the development and implementation of a comprehensive industrial strategy for photonics in Europe. The action should include the development of strategic technology road-maps, strong stakeholder engagement (in particular Photonics21 stakeholders, National Technology Platforms, regional Clusters, end-user industries), coordination of regional, national and European strategies and priorities, fostering collaboration with other European Partnerships to identify synergies and fields of common interest, and fostering strategic collaboration with financial institutions to improve financing conditions for Photonics industry, e.g. loans for growth financing, Venture Capital.

**Fostering careers in photonics:** the objective is to reach out to STEM graduates/PhD students and young postdocs in order to encourage more of them to pursue a career in photonics. Actions should help make students more industry ready and should provide the appropriate training, encourage innovation and entrepreneurship. Gender issues must also be addressed.

Up to one proposal will be selected for each of the dimensions.

This topic implements the co-programmed European Partnership Photonics.

## **AI, Data and Robotics**

HORIZON-CL4-2023-DIGITAL-EMERGING-01-01: Novel paradigms and approaches, towards AI-driven autonomous robots (AI, data and robotics partnership) (RIA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 8.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [29-32] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to the following outcome(s):

* Achieve substantial “next step autonomy” in robots, undertaking non-repetitive tasks in realistic settings, including Human-Robot interactions, as well as robots acting in isolation, demonstrated in key high impact sectors (e.g. healthcare, agrifood/agriculture, cities, remote areas such as offshore and subsea, harsh environments such as process industries, manufacturing industries, logistics and transport, maintenance and repair of infrastructures). This next step autonomy should clearly delineate from state of the art solutions and can be illustrated by the following non-exhaustive examples:
  + In autonomy to reach the point where the robot systems, operating in complex and dynamic working environments can autonomously select the tasks and task sequences that are needed to achieve long term mission goals over long periods of autonomous operation, relative to the current state of the art, and are able to react and adapt to changes in both the environment and to the external instructions received from unskilled or semi-skilled human users. For example in being able to carry out maintenance tasks on a structure after having conducted an inspection to ascertain the type of maintenance needed (e.g. on a wind turbine or in an industrial processing facility such as an oil refinery) or in the maintenance of city infrastructure such as waste water systems or road and rail infrastructure.
  + In human interaction to reach the point where robots are able to autonomously adapt in order to socially interact with people in an everyday working environment in order to achieve task outcomes through intuitive interaction that is multi-modal; by voice, physical, gestural etc. and to collaboratively achieve complex tasks that require multiple functional capabilities where humans and robots contribute equally to those capabilities. For example in complex healthcare tasks such as patient handling or in complex logistical operations such as the optimal packing of consumer goods for shipping.
  + In manipulation, to be able to achieve more complex manipulative tasks autonomously, requiring advanced perception and task understanding, as well as adaptive planning to anticipate possible changes in the environment.
* Accelerate enabling conditions essential for the diffusion of robots in various industries, sectors and services which can either 1) handle tasks autonomously, and safely, for a long periods of time significantly beyond the current state of the art in each sector and service addressed and 2) interact safely and smoothly to support humans in their daily activities, based on a strong multidisciplinary approach, including the relevant SSH dimension considering both human and societal factors.
* Make and exploit major advances in science and technology, to maintain Europe’s scientific excellence and ensure sovereignty of key technologies in robotics and autonomous systems expected to affect the society in contributing to addressing major societal and economic challenges.
* Step change in autonomy of robots including Human-Robot interaction and robots acting in isolation demonstrated in key high impact sectors (e.g. healthcare, agrifood/agriculture, etc) under realistic settings.
* Step change in enabling conditions essential for the diffusion of robots in various industries, sectors and services which can either 1) handle tasks (semi-)autonomously, and safely, for a sufficiently long period of time and 2) interact safely and smoothly to support humans in their daily activities, based on strong multidisciplinary approach, including the relevant SSH dimension.
* Major advances in science and technology, to maintain Europe’s scientific excellence and ensure sovereignty of these key technologies expected to affect the society in contributing to addressing major societal challenges.

Scope:

The currently low level of autonomy achieved by most robotics systems is a major obstacle to the wide-scale deployment of robots with advanced capabilities in many real-world applications. Most robots still require an important level of human supervision[[122]](#footnote-123). However, in many potentially valuable applications robots need to work with greater levels of autonomy to create effective end user added value.

Future robotic systems will be required to autonomously adapt and alter their behaviours to respond to changes in the working environment and adjust to changes in task requirements without direct human supervision.

Achieving next step autonomy in robotics will require greater integration of AI technologies into the physical functioning of robots. This in turn requires AI to operate in real time at pace with the physical motion of the robot. Interpreting the working environment, interacting with complex objects or people and making and updating decision making, all in real time, requires a significant advance from the current state of the art. This will require novel architectures both in software and hardware and will require AI algorithms compatible with physical, real time, robot operation. In terms of R&I advancement a paradigm shift is needed to remove silos between disciplines in order to weld together expertise and create a conceptual shift to reach the goals of next step autonomy for robotics.

The primary outcome will be that important applications for robots become possible as a result of achieving next step autonomy in specific use cases and sectors.

Achieving this goal will require improvements in perception, awareness of the operating environment, the ability to anticipate and an improved understanding of the consequences of particular sequences of action on the working environment.

Proposals will need to address safety and security aspects at all levels, as well as consider the handling of data collection (respecting relevant regulation such as the GDPR and the revised Machinery Directive).

Proposals should address several of the following aspects of autonomy:

* Long-term, and where appropriate lifelong, autonomy of behaviour and energy (including frugality in terms of energy, lower environmental footprint, using new materials, designed to be recycled or easily repaired etc.)
* The autonomous adaptation of behaviours in dynamic environments.
* The development of robust and safe autonomy, including the development of risk averse systems or systems operating with low levels of communication or periods of communication denial.
* The use of high level sources of information such as semantic information or externally held knowledge of the working environment, to improve autonomy.
* Mechanisms for advanced human interaction with systems capable of long term autonomy.
* The impact of physical self-reconfiguration on autonomy
* The development of collective autonomy using multiple robots

Multidisciplinary research activities should address all of the following:

* Proposals should involve appropriate expertise in all the relevant disciplines, such as engineering, computer sciences, mathematics, Social Sciences and Humanities (SSH), neuroscience, psychology, cognitive sciences, philosophy, biology, etc. SSH is particularly relevant in addressing aspects related to the human-robot interaction, sensible task distribution between humans and robots, agency, control, trust and handling of data collection, to achieve usability, trustworthiness, safety and adoption of the developed solutions.
* It is essential that scientific and technological results are reproducible and re-usable in order to contribute to the advancement of the targeted research area.
* S&T progress should be demonstrated through use-cases with major and broad socio-economic impact.
* End-users should be involved, as scenario providers, to set the requirements, success criteria and context, for the targeted sectors and/or use-cases that inform the technological challenges to be addressed in the projects.
* Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives.
* Contribute to making AI and robotics solutions meet the requirements of Trustworthy AI, based on the respect of the ethical principles, the fundamental rights including critical aspects such as robustness, safety, reliability, in line with the European Approach to AI. Ethics principles needs to be adopted from early stages of development and design.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating well defined potential added value to end-users), and share communicable results with the European R&D community, through the AI-on-demand platform or Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

This topic implements the co-programmed European Partnership on AI, data and robotics.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-03: Novel paradigms and approaches, towards AI-powered robots– step change in functionality (AI, data and robotics partnership) (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 8.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [29-32] million. |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Achieve the substantial next step in the ability of robots to perform non-repetitive functional tasks in realistic settings, based on underlying robot technologies (e.g. guidance/navigation/manipulation/interaction etc.), demonstrated in key high impact sectors (for example in healthcare, agrifood/agriculture, cities, remote areas such as offshore and subsea, harsh environments such as in the energy industries, maintenance and repair of infrastructure). This next step functionality should clearly delineate from state of the art solutions and can be illustrated by the following non-exhaustive examples:
  + In interaction to reach the point where the robot systems operating in harsh complex and dynamic working environments can carry out more advanced functions that would normally be carried out by humans but where safety constrains limit or severely constrain humans from doing so. For example being able to disassemble a structure in order to replace a worn part where there may be corrosion or dirt accumulation obscuring or preventing the normal disassembly process. Or achieve physical human interactions that adapt to the characteristics of the human with regard to their characteristics such as interaction speed, height, handedness etc.
  + In navigation to reliably and purposefully move between destinations within complex people centric environments that are occupied such as busy transport hubs, shopping malls or entertainment and sporting venues; or to move maintaining a direction of travel over terrain where the surface is shifting and reactive to the robot’s motion for example on sand, gravel or waterlogged ground; or to be able to navigate, move and transition between water and air or water and land including mixed surfaces.
  + In manipulation to reach human speed with equivalent dexterity, or manipulate objects beyond human capability, such as very small objects, or very precise manipulation tasks, or vary big objects, beyond current capabilities and functionalities; to manipulate complex articulated objects either as part of an assembly task or in order to use those objects as tools to achieve a specific function. For example handling a complex articulated part while a processing operation is taking place on it; or to manipulate and assemble soft objects or materials that deform under their own weight such as textiles as a part of a useful process.
* Step change in the enabling conditions essential for the accelerated diffusion of robots in various industries, sectors and services which can 1) handle tasks efficiently, robustly, and safely and 2) interact naturally and smoothly to support humans in their daily activities, based on a strong multidisciplinary approach, including the relevant SSH dimension.
* The development, use and exploitation of major advances in science and technology for the enhancement of European robotics, in order to maintain Europe’s scientific excellence and ensure sovereignty of key technologies relevant to robotics
* Create opportunities to affect society in the longer term by contributing to impact on major broad societal challenges.

Scope:

For robots to be usefully and efficiently deployed to perform new activities in physical interaction with the real world requires an improvement in and expansion of the range of functionalities robots can deploy.

This needs to take place in sectors where the capabilities of robots can be utilised to progress productivity in critical industries, support European industries essential for sovereignty and in sectors with high impact across Europe such as manufacturing, healthcare, agri-food, construction etc.

In particular the following major areas of functional performance need to be progressed to the next level of performance:

* significant enhancement of navigation capabilities in order to enhance mobility (underwater, on the ground, in the air, in the body, in areas difficult to reach, on rough terrain, in unpredictable environments, in areas including people or other moving agents, etc.), particularly in highly dynamic and complex environments.
* extension of manipulation capabilities to address: of
  + large (of the order of metres to 10s of meters in scale), or heavy (of the order of 100kg to multiple 100kg )
  + or small objects of millimetre or centimetre scale, or smaller; ,
  + or of objects that are soft, deformable, articulated, delicate or hazardous objects;

Each of these require significant advances in precision, force, speed, re-planning, physical perception, grasping, manipulation (including bi-manual), etc.), in order to achieve beyond human capability in manipulation and dexterity.

For large scale manipulation applications include but are not limited to manufacturing, assembly, maintenance and installation of large infrastructure; for example wind turbines, energy pylons, pipelines, dwellings, industrial buildings, transport infrastructure etc.)

For small scale manipulation applications include but are not limited to medical and healthcare (human and animal), pharmaceutical and laboratory automation, process industries, materials processing and micro-fabrication and assembly.

* significant enhancement of functional interaction capabilities to deliver efficient, safe and natural interaction with people, objects, with other robots, within complex and dynamic working environments, including the ability to adapt to variation in the working environment and the needs and dynamics of users, objects and structures, etc.).

Making significant next step advances in these functional capabilities will require paradigm shifts in terms of both physical and systems architecture particularly through the removal of silos between disciplines that contribute to robotics functionalities.

Proposals will need to address safety and security aspects at all levels, as well as consider the data life cycle in line with GDPR.

Proposals should aim to address bold and significant challenges to the enhancement of robot functionality and do so by utilising multidisciplinary research activities.

Proposals should address several of the following in the context of improved functional performance relevant to deployment barriers in a high impact sector:

* Robust perception and the integration of sensing into physical structures to enhance motion and perception
* Advanced safe and reliable navigation functionalities, integrating anticipation, re-planning, high-level goal optimisation. Natural human-robot interaction functionality
* Advanced cognitive capabilities, integrating any type of learning (from experience, collaborative intelligence or learning from human knowledge, frugality in terms of data, unsupervised, etc.), modelling, reasoning, introspection, etc.
* Novel design approaches, e.g. soft robotics, under-actuated, miniaturised, modular/reconfigurable robots including those capable of self-reconfiguration, e.g. for guidance/navigation/manipulations in places hard to reach
* Mobile manipulation, natural manipulation of arbitrary objects including soft, fragile or other items complex to handle (e.g. dirty, slippery, deformable)
* Advanced navigation/manipulation in extreme environments, extremely small and precise in the body, autonomous navigation on shifting and uneven surfaces and in transition, for example between water and air or water and land, field robotics in harsh environments, the handling and manipulation of extremely large/heavy objects, etc.

Where relevant, proposals should contribute to making AI and robotics solutions meet the requirements of Trustworthy AI, based on the respect of the ethical principles, the fundamental rights including critical aspects such as robustness, safety, reliability, in line with the European Approach to AI. Ethics principles need to be adopted from early stages of development and design.

Critical to success will be the interaction of End Users in the definition of the problem domains and use cases that act as barriers to long term deployment and uptake across multiple sectors. Proposals should involve appropriate expertise in the necessary relevant disciplines to reach their objectives, such as engineering, computer sciences, mathematics, Social Sciences and Humanities (SSH), neuroscience, psychology, cognitive sciences, philosophy, biology, etc. SSH is particularly relevant in addressing human aspects around the human-robot interaction, sensible task distribution between humans and robots, agency, control, trust and handling of data collection, to achieve usability, trustworthiness, safety and adoption of the developed solutions.

It is essential that scientific and technological results are reproducible and re-usable in order to contribute to the advancement of the targeted research area.

S&T progress should be demonstrated through use-cases with major and broad socio-economic impact.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating concrete potential added value), and share communicable results with the European R&D community, through the AI-on-demand platform or Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

This topic implements the co-programmed European Partnership on AI, data and robotics.

**HORIZON-CL4-2023-DIGITAL-EMERGING-01-02: Industrial leadership in AI, Data and Robotics – advanced human robot interaction (AI Data and Robotics Partnership) (IA)[[123]](#footnote-124)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 10.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [29-32] million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* To reach the point where human robot interaction, extended in time and scope beyond the current state of the art, adds value and improves the quality of outcome for complex tasks; for example service tasks, or complex industry processing tasks or tasks in a healthcare setting. Where the focus is on tasks where robotics can add capabilities that extend human ability but which require human interaction to be achieved. These tasks will require varying levels of interaction and communication, dependent on the current state of the task, but will essentially require close interaction over extended periods of time.
* Validate AI, Data and Robotics at scale by demonstrating the potential of integrating these technologies to address challenges in key industries and develop solutions that address human robot interaction at all levels from physical interaction to social interaction in a variety of working environments.
* Make and exploit major advances in technology, to maintain Europe’s excellence and ensure sovereignty of these key technologies expected to affect society by contributing to addressing major societal challenges by enhancing interactions between robots and people. Boost the innovation potential for wide uptake of AI, Data and Robotics by significantly improving the ability of robots to work in collaboration with humans as equals.

Proposals should demonstrate the added value of integrating AI, Data and Robotics technologies through large-scale validation scenarios reaching critical mass and mobilising the user industry, Focus should be given to attracting new user industries, to boost the uptake of AI, Data and Robotics in major sectors and stimulate the involvement of end-users where appropriate. Besides major industries, these Actions should also involve SMEs and/or startups with high potential to foster innovation that advances the nature and level of interaction between people and robots, especially dealing with paradigmatic shifts in working practice that create improvements for industry and society. Proposals should target sectors and application domains with wide-scale deployment potential and maximum contribution to the European economy.

Multidisciplinary innovation activities should address one of the following:

* Development of innovative solutions to address major application-driven challenges, involving a large set of SMEs/ midcaps developing innovative solutions in order to boost the innovator community in Europe. This action will also aim to expand the deployment of software engineering dedicated to human robot interaction. Especially to extend and adopt the practices of the Digital Industrial Platform for Robotics, and to stimulate the robot operating system (ROS) industrial community in Europe and to expand the number and variety of high quality industrially deployable modules shared in ROS related to human robot interaction at all levels, fostering the widespread deployment of such technologies in the targeted application sector and beyond.
* Large scale pilots bringing major industries from key application sectors in Europe – facilitating collaboration between these major companies and innovative SMEs/Start-ups/academia/tech-transfer organisations with the goal is to exploit re-usable tools and solutions in various human robot interaction use-cases/sectors (showing scalability/versatility, and allowing economies of scale)

Proposals should involve appropriate expertise in all the relevant disciplines, such as engineering, computer sciences, mathematics, Social Sciences and Humanities (SSH), neuroscience, psychology, cognitive sciences, philosophy, biology, etc. and in particular must involve the relevant expertise to address the human factors aspects of robot human collaboration at all levels of interaction

Security, privacy and safety should be taken into account to minimise risks to users both in terms of physical harm and in terms of digital privacy and security.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Proposals should contribute to making human robot interactions using AI and robotics solutions meet the requirements of Trustworthy AI, based on the respect of the ethical principles, the fundamental rights including critical aspects such as robustness, safety, reliability, in line with the European Approach to AI. With these principles being adopted from the early stages of development and design through to deployment.

Proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating well defined added value to end users), and share communicable results with the European R&D community, through the robotics elements of the AI-on-demand platform and/or the Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

This topic implements the co-programmed European Partnership on AI, data and robotics.

**HORIZON-CL4-2024-DIGITAL-EMERGING-01-04: Industrial leadership in AI, Data and Robotics boosting competitiveness and the green transition (AI Data and Robotics Partnership) (IA) [[124]](#footnote-125)[[125]](#footnote-126)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 10.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [57-63] million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. As third parties' grants may include robotics components, requiring high equipment investment and/or important effort to integrate in a use-case to address robotics challenges, the maximum amount to be granted to each third party is EUR 200 000. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to one of the two following outcomes, exclusively:

* The creation of systems to address large scale challenges using combined robotics data and AI solutions that have significant impact on the objectives of the green deal. For example; in improving domestic energy consumption or in the cleaning up of contaminated land and waterways or in accelerating the circular economy along the complete value chain through automated waste processing or reuse of materials.
* The creation of systems to address large scale resource optimisation challenges using combined AI and Data solutions, that have significant impact on the objectives of the green deal, such as optimisation of any kind of resources, from production to use along the complete value chain (see above), in order to minimise waste or foster the reuse of resources or in using AI and data solutions to maximize energy efficiency, ensuring energy security.

Which will contribute to

* The validation of solutions at scale by demonstrating the potential of integrating these technologies to address challenges in industrial ecosystems and develop solutions that are environmental friendly and contribute to the green deal
* Making and exploiting major advances in science and technology, to maintain Europe’s scientific excellence and ensure sovereignty of these key technologies expected to affect the society in contributing to addressing major societal challenges affecting the environment.
* Exploring deployment solutions that can ensure efficient scale up
* Boosting the uptake of AI, Data and Robotics to exploit the major contribution expected to environmental sustainability.

Scope: Proposals should demonstrate the added value of integrating either AI and Data, or AI, Data and Robotics technologies through large-scale validation scenarios reaching critical mass and mobilising the user industry, while demonstrating high potential impact contributing to the European Green Deal objectives. For example in the recycling of electric car batteries, cleaning and monitoring the oceans, decommissioning energy infrastructure, supporting the recycling of materials, the optimisation of energy usage, the minimisation of resource waste in value-chains, for example through the better adaption of production to demand, etc.

Focus should be given to attracting new user industries, and/or showing new business opportunities to boost the uptake of AI, Data and Robotics in major sectors and stimulate the involvement where appropriate of end-users to define the technological barriers to uptake and the use cases for deployment.

Proposals should address the involvement of SMEs and/or start-ups with significant potential to foster innovation through their engagement with large scale pilots. Focus will be on leveraging and nurturing emerging collaborations between stakeholder communities shaping an effective eco-system fit for the challenge of European AI, Data, Robotics, and on accelerating European R&I through structural involvement of innovative SME and deep-tech start-ups.

Proposals should target sectors and application domains with wide-scale deployment potential and maximum contribution to the green deal.

Multidisciplinary innovation activities should address one of the following:

* Large scale pilots bringing major industries from key application sectors in Europe – facilitating collaboration between small and large companies with the goal of exploiting and integrating existing tools, sub-systems and solutions that are re-usable from other sectors (thereby showing scalability/versatility, and enabling economies of scale) to have significant impact on the objectives of the green deal.
* The development of large scale pilots addressing key applications with a significant and scalable impact on the objectives of the green deal by facilitating collaboration between small and large companies able address key challenges in the deployment of AI, Data and Robotics and where funding support for third parties (FSTP) is used to leverage novel technical advantage to address the construction and operation of the pilot and to thereby support End Users and service providers in addressing the challenges of the green deal.

Proposals should either involve directly, or indirectly, appropriate expertise in other relevant disciplines for example related to environmental science and, as necessary, Social Sciences and Humanities (SSH) disciplines, especially where this is relevant to validating the effectiveness of proposed systems and technologies with respect to the green deal objectives.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating well defined added value to end users), and share communicable results with the European R&D community, through he AI-on-demand platform and/or the Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

This topic implements the co-programmed European Partnership on AI, data and robotics.

## **Graphene and 2D materials: Europe in the lead**

HORIZON-CL4-2024-DIGITAL-EMERGING-01-31: pilot line(s) for 2D materials-based devices (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR [31-35] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [31-35] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B. |
| *Links with other topics* | * HORIZON-CL4-2022-DIGITAL-EMERGING-01-17/18/19/20/22 * KDT JU |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Broadly accessible pilot line(s) fostering the creation of electronic and photonic devices and systems (co-)integrating 2D materials (2DM).
* Significant progress towards the adoption of the 2DM in the silicon and semi-conductor arena by allowing the production of new (co-)integrated devices and systems in a quality controlled way.

Scope:

Proposals should establish a 2DM pilot line(s), where European companies, research centres and academic institutions, can produce on a pilot scale novel electronic and/or photonic devices and systems integrating 2DM. Proposals must continue the efforts started in the 2D experimental Pilot Line[[126]](#footnote-127) of the Graphene Flagship and build on the IP developed therein.

Proposals should focus on the (co-)integration of 2DM with established technologies such as CMOS integration and heterogeneous integration.

Proposal should include supply of standard semiconductor technologies such as CMOS, Asics, planarized waveguides already adapted/optimized for 2DM co-integration.

Proposals should specify targeted added value(s) against current technologies of the integrated devices and systems as well as the starting and ending TRLs for the targeted applications

Multidisciplinary research and innovation activities should address all of the following:

* Building the toolkit and design modules necessary for creating prototype devices and systems, characterise and assess their performance and their ability to cover the device requirements of the targeted applications;
* Process characterisation and monitoring to control and guarantee quality of relevant device parameters and to allow yield predictions of the integrated devices.
* Adaptation of standard semiconductor technologies including passivation schemes, strategies to align devices over different technologies, modules to contact the 2D devices with the periphery, optimized planarization strategies and packaging services.
* Reliability and packaging requirements;
* Implementing multiple wafer runs or other offering to best cover business opportunities;
* Defining a sustainable model of functioning beyond the project lifetime and include activities preparing for the later transfer of the pilot line to an industrial production environment; examples of such activities include addressing relevant cost issues and market perspectives, potential business partners, etc.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.

Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

Proposals should also cover the contribution to the governance and overall coordination of the Graphene Flagship initiative.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-32: Sustainable safe-by-design 2D materials technology (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [9-11] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Lump-sums* | YES |
| *Links* | * HORIZON-CL4-2022-DIGITAL-EMERGING-01-17/18/19/20/22 * HORIZON-CL4-2023-RESILIENCE-01-21/22/23/24 |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Development of Safe and Sustainable by Design 2DM technology.
* Societal acceptance of 2DM and 2DM-based technologies.
* A set of robust and verified assays for toxicity and eco-toxicity testing of 2D materials (2DM), to support regulatory requirements for their registration and authorisation for use (OECD test guidelines, REACH compliance, authorisation pathways)

Scope:

The increasing commercial exploitation of 2DM necessitates a comprehensive evaluation of their potential impact on human health and the environment. It is thus of utmost importance for 2DM technology development to understand the properties that underlie the potential toxicity of these materials. Since not all 2DMs are alike, it is essential to disentangle the structure-activity relationships for this class of materials.

Proposals should aim to ensure a safe development of 2DM technology and in the long term, a sustainable market entry/penetration of 2DM-based products. Proposals should comply with the Safe and Sustainable by Design framework and criteria.

Multidisciplinary research and innovation activities should address all of the following:

* Critical examination of 2DM health and environment issues, ranging from general toxicology, to occupational health and environmental impact.
* Studies and tests of biocompatibility and safety of 2DMs and composites along their lifecycle;
* Development of solutions to modulate potential risks by developing appropriate chemical/physical approaches towards safer manufactured materials and nanomaterials (safe-by-design 2DMs).
* Assessing the safety of 2DMs and composites at different TRL levels to develop and test best practices along the product development process, from prototypes to products tested in relevant environments in order to guarantee the highest impact possible.
* Development of validation processes supporting regulatory assessment.

Proposals submitted under this topic should include an exploitation strategy, as outlined in the introduction to this Destination.

Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

Proposals should also cover the contribution to the governance and overall coordination of the Graphene Flagship initiative.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-33: 2D materials of tomorrow (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [11-13] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 4 by the end of the project – see General Annex B. |
| *Lump-sums* | YES |
| *Links* | HORIZON-CL4-2022-DIGITAL-EMERGING-01-17/18/19/20/22 |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* A broad portfolio of innovative 2D materials (2DM), networks and multicomponent hetero-structures exhibiting new properties or complementary functionalities that will lead to breakthroughs in digital systems and devices.

Scope:

Proposals should create the basis for the exploitation of most promising 2DM and developed 2DM technologies.

Proposals should develop high-quality 2DM and hetero-structures platforms by exploiting most promising emerging 2DM and/or discovering new ones, and combining them in functional systems and hetero-structures. This should be achieved by pushing the boundaries of growth, characterisation methods, deposition and layer-by-layer assembly of atomically thin crystals supported by multiscale theoretical modelling of materials and devices.

Multidisciplinary research and innovation activities should address all of the following:

* Identification and demonstration of new properties and physical phenomena such as those based on the twist degree of freedom, and processes enabling new functionalities, and their implementation in proof-of-principle digital devices;
* development of new characterisation methods and of controlled, ultra clean and large scale synthesis, fabrication methods and design of 2D materials and hetero-structures based on novel approaches e.g. Artificial Intelligence assisting material assembly and material simulation, robotics-based assembly, and advanced synthetic, preparation and growth methods combined with the help of modelling and simulation.

Proposals should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

Proposals should also cover the contribution to the governance and overall coordination of the Graphene Flagship initiative.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-34: Synergy with national and regional initiatives in Europe (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 3 million. |
| *Type of Action* | Coordination and Support Action |
| *Lump-sums* | YES |
|  | * HORIZON-CL4-2022-DIGITAL-EMERGING-01-17/18/19/20/22 |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Well-coordinated European, national and regional initiatives in the field of graphene and 2D materials (2DM);
* Further development of a strong European innovation ecosystem in 2DM-based technologies.

Scope:

Proposals should support the coordination between relevant national and regional public authorities funding research and innovation in 2DM-based technologies. This coordination should allow them to work synergistically with the goal to strengthen and complement the EU funded activities in the domain.

Coordination and support activities should address all of the following:

* Active networking of relevant initiatives and R&I communities;
* Active follow-up of the projects funded under FLAG-ERA;
* Maintaining an inventory of funding and scientific landscapes in the domain of 2D materials in Europe, for both basic and applied research.
* analysing gaps and overlaps and contributing to topics that could be included in national/regional research agendas in the field;
* supporting the national and regional actors to organise joint calls for proposals between their respective programmes and initiatives for supporting in Europe the further development of a strong innovation ecosystem in Graphene;

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

## **Flagship on Quantum Technologies: a Paradigm Shift**

The new Digital Decade strategy includes an ambitious target in quantum technologies: “By 2025, Europe will have its first computer with quantum acceleration paving the way for Europe to be at the cutting edge of quantum capabilities by 2030”. Reaching that goal will strengthen European open strategic autonomy and limit Europe’s dependency on external suppliers of quantum devices. It will stimulate a quantum ecosystem supported by industry developments and technology transfers from research labs to fabrication, boosting market uptake and facilitating the early development of industry standards.

In quantum computing, a number of different qubit platforms are showing the potential to become the transformative machines of the future, and Europe needs to explore the widest range of promising technologies possible. The WP for 2023-24 will enable the Quantum Technologies Flagship to advance the research into different qubit technology platforms that it has already pursued and to extend its support to further high-potential technology platforms. This will be complemented by the development of a European quantum software ecosystem, intensifying efforts to programme quantum computing platforms and devise more practical applications with larger user communities.

The WP will also see the Flagship expanding its focus on quantum sensing and metrology, a relatively advanced field of quantum where potential commercial applications are already on the horizon. There will be enhanced support for actions aiming to enlarge the type of sensing devices or parameters that can be measured by quantum sensors, but also to bring more developed quantum sensing devices close to a mature level where they can be taken up for industrial manufacturing and enhance or develop new sensing applications..

Finally, the WP will continue to support basic quantum research to explore alternative implementations and approaches to quantum technologies and to unlock the potential of next generation technologies (including basic theories and components), as well as to address the deficiencies that more mature approaches have not yet resolved.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-41: Investing in alternative quantum computation and simulation platform technologies (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR 3 – 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [14-16] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States, Iceland and Norway.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| Link with other topics in other WPs | DEP: Future EuroHPC JU Calls for acquisition and operation of Quantum computers, and their integration with the HPC and data infrastructure.  HE: Strengthening the quantum software ecosystem for quantum computing platforms (RIA) HORIZON-CL4-2021-DIGITAL-EMERGING-02-10 |

Expected Outcome: Proposals are expected to further mature alternative and promising quantum computation and simulation platforms which have the prospects of high scalability and programmability,, to complement the ones already supported by the Quantum Technologies Flagship.

Scope: In order to reach large-scale quantum computation and simulation in Europe, breakthroughs in scalability of quantum processors and simulators, devices and integrated platforms are needed, together with the ability to perform all necessary operations of the quantum systems to have a fully programmable quantum computer or simulator.

The development of alternative quantum computer and simulator systems and platforms, based for example on photonic or NV-centre platforms, should be integrating the key building blocks such as individual quantum systems (i.e. >10 qubits for a quantum computer and >50 quantum units for a quantum simulator), control electronics, quantum software stack, use case applications, etc. Work should address the scalability towards large systems (>100 qubits for a quantum computer and >1000 quantum units for a quantum simulator), the verification and validation of the quantum computation or simulation, solving a concrete problem to demonstrate the quantum advantage. In addition, quantum computation platform should explore fault-tolerance.

Proposals should also cover:

1. the cooperation with the complementary projects launched specifically in the area of the enabling quantum software stack (see HORIZON-CL4-2021- DIGITAL-EMERGING-01-10: Strengthening the quantum software ecosystem for quantum computing platforms), including also the need to establish from the beginning of this cooperation appropriate IP exploitation agreements;
2. the cooperation and coordination with the Flagship initiatives supporting the establishing of key European fabrication processes, technologies and supply chain for the proposed platform.
3. any additional support they may receive from relevant national, or regional programmes and initiatives; and
4. contribution to the governance and overall coordination of the Quantum Technologies Flagship initiative. They should also contribute to spreading excellence across Europe, for example, through the involvement of Widening Countries.

In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-42 Stimulating transnational research and development of next generation quantum technologies, including basic theories and components (Cascading grant with FSTP)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR [14-16] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [14-16] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries. Proposals including legal entities which are not established in these countries will be ineligible. This decision has been taken on the grounds that, in the area of research covered by this topic, EU open strategic autonomy is particularly at stake. It is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security169 |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 0.7 million in order to allow third parties to achieve closer coordination and greater mobilisation and pooling of resources between regional, national and EU research programmes for realising the research goals of the Quantum Flagship in the area of quantum technologies. Activities are expected to start at TRL 2 and achieve TRL 3-4 by the end of the project. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Support to transnational projects in quantum technologies, fostering synergy between European, national and regional initiatives and promoting broader partnerships between the European stakeholders in quantum technologies.

Scope: Proposals should support the networking and coordination of national activities in support of the Quantum Flagship by implementing calls for proposals resulting primarily in grants to third parties in this area, in accordance with the provisions of the General Annexes. i) the aspectsgaps in the Strategic Research Agenda, not covered by the Flagship activities; (ii) support transnational efforts in guaranteeing availability of critical technologies, materials and resources essential for a competitive development of next generation quantum technologies and central to strategic supply chains for an autonomous and technologically sovereign pan-European quantum ecosystem; (iii) support early-stage involvement of industry in transnational R&D agendas to next generation quantum technologies, emphasizing high inclusion and participation of SME and start-ups in realizing an innovative and agile pan-European quantum ecosystem.

Proposals are expected to use financial support to third parties (FSTP) to achieve closer coordination and greater mobilisation and pooling of resources between regional, national and EU research programmes for realising the research goals of the Flagship in the area of quantum technologies. At least of 85% of the EU budget is expected to be dedicated to FSTP and the maximum amount of FSTP is EUR x million per third party for the entire duration of the action. Consortia are expected to implement co-funded joint call for proposals that leads to the funding of transnational research and/or innovation projects, for which the Commission estimates that an amount of EUR 0.7 million per project would allow the expected outcomes to be addressed appropriately. The co-funding balance between regional, national and EU contribution should target an EU funding rate of 33%.

Proposals should make provisions to actively participate in the common activities of the Quantum Flagship and in particular contribute to the activities of the existing Quantum Coordination and Support Action.

Proposers should submit appropriate documents in order to ensure that the participating national funding agencies commit to provide the national contribution equal to 67% of the FSTP grants’ value.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-43: Framework Partnership Agreement for developing large-scale quantum Computing platform technologies (FPA)

Restrictions of Article 22.5 will apply.

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| **Specific conditions** | |
| *Expected EU contribution per project* | N/A |
| *Indicative budget* | N/A |
| *Type of Action* | Framework Partnership Agreement |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States, Iceland and Norway.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| Link with other topics in other WPs | DEP: Future EuroHPC JU Calls for acquisition and operation of Quantum computers, and their integration with the HPC and data infrastructure.  HE: Strengthening the quantum software ecosystem for quantum computing platforms (RIA) HORIZON-CL4-2021-DIGITAL-EMERGING-02-10 |

Expected Outcome: The Framework Partnership Agreement (FPA) in quantum computing is expected to establish a stable and structured partnership between the Commission and the institutions and organisations in quantum computing who commit themselves to establishing, maintaining and implementing a strategic research roadmap aligned with and contributing to the Quantum Flagship Strategic Research Agenda in a scalable open quantum computing platform based on a specific quantum platform technology.

This partnership will be set up through a FPA, which will enable the completion of the research roadmap within the context of the agreement.

The consortia responding to the call may include research institutes, universities, RTOs, foundations, industry, SMEs as well as other organisations that can play a role in the realisation of these quantum computing platforms. The FPA will specify the objectives, the nature of the actions planned, and the procedure for awarding specific grants. The FPA is expected to contribute to the following outcomes:

1. Demonstrate a universally programmable processor of at least 200 physical qubits (by 2027) operating in the NISQ[[127]](#footnote-128) domain including firmware and having sufficient coherence to perform computations involving all of its qubits; characterised with a hardware-agnostic test suite, including real-world applications, including for hybrid quantum/HPC computing, and the capability of out-performing classical computers on a number of relevant real-world use-cases; control needs to involve a low-level control system, a compiler and a scheduler.
2. By 2029, build a full stack, highly connected, high fidelity quantum computer of at least one thousand physical qubits, exhibiting scalability and capable of out-performing classical computers on relevant real-world use-cases.
3. Formulate standards and interface specifications for a complete software and hardware stack including remote, cloud-based access.

Scope: Fostering a vibrant European quantum computing industry will require hardware, software, and the development of user interfaces and applications. Proposals for this FPA are expected to build on the quantum computing platforms supported under the Quantum Flagship ramp up phase. Proposals should target the development of open quantum computing platforms compatible with the fabrication techniques of the semiconductor industry (e.g. silicon spin qubits), integrating the key building blocks such as quantum processors in the NISQ regime (>100 semiconductor qubits) with control electronics, low-level software, verification and validation of the quantum computation, etc.

Proposals should include practical strategies towards the break-even point of fault tolerance to increase algorithmic depth (number of operations) for quantum computing on existing platforms.

Proposals for the FPA must describe how the activities carried out during the ramp-up phase will be continued involving the relevant disciplines ,technologies and stakeholders, how results of the ramp-up phase will be used, and how they will provide efficient coordination under strong scientific and engineering leadership.

Proposals for the FPA should also address how to integrate in this platform a full software stack, including a compiler and scheduler, programming tools, a suite of algorithms, use cases etc., that would allow them to showcase their capability of solving real and concrete computational problem(s) that demonstrate a quantum advantage and to make progress towards fault tolerance.

Proposals should aim at the development of open quantum computer experimental systems, and work on the reduction of their form factor.

Proposals for FPAs should also cover: (i) the cooperation with complementary projects previously launched, specifically in the area of the enabling quantum software stack (see HORIZON-CL4-2021-DIGITAL-EMERGING-02-10: Strengthening the quantum software ecosystem for quantum computing platforms), including also the need to establish from the beginning of this cooperation appropriate IP exploitation agreements; (ii) the collaboration with other initiatives or programmes at regional, national, transnational or global level; (iii) any additional support they may receive in their activities from relevant national, or regional programmes and initiatives; and (iv) contribution to the governance and overall coordination of the Quantum Technologies Flagship initiative. (v) relevant aspects of cooperation with European industry and SMEs/ They should also contribute to spreading excellence across Europe; for example, through the involvement of Widening Countries.

The partnership will have a duration of 4 years.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-44: Next generation quantum sensing and metrology technologies (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 2 and 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [9-11] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, participation in this topic is limited to legal entities established in Member States, associated countries, OECD countries. Proposals including legal entities which are not established in these countries will be ineligible. This decision has been taken on the grounds that, in the area of research covered by this topic, EU open strategic autonomy is particularly at stake. It is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security169 |

Expected Outcome: Projects are expected to contribute to demonstrate the feasibility of next generation quantum sensing and metrology technologies and devices by showing disruptive progress in the performance, reliability and efficiency and applicatio of such technologies and devices and by enhancing the TRL of all (essential) components necessary to build them.

Scope:

Proposals should focus on next generation quantum sensors and metrology devices such as for example quantum enhanced spectroscopy and imaging, including entangled and/or superposition based clocks, quantum opto-mechanical sensing devices, squeezed states of light. They are expected to that provide extreme precision and accuracy measurements in many fields, beyond the performance of consumer devices and services, in applications such as for example from medical diagnostics, and imaging, quantum enhanced spectroscopy and imaging, entangled clocks, inertial sensors, high and quantum opto-mechanical sensing devices, high-precision navigation, and monitoring, ultraprecise time standards in aerospace or information networks, quantum-imaging and non-line-of-sight imaging, quantum communications and cryptography relevant for security, communication to future applications in the Internet of Things.

Proposals should address: (i) the development of new methods and techniques to achieve full control over all relevant quantum degrees of freedom and to protect them from environmental noise; and/or (ii) identify correlated quantum states that outperform uncorrelated systems in a noisy environment and methods to prepare them reliably. Proposed work should exploit quantum properties (such as coherence, superposition and entanglement) emerging in quantum systems to improve the performance of the targeted sensors technologies (e.g. in terms of resolution, sensitivity or noise), well beyond the classical limits.

Proposals should target the development of laboratory prototypes (from TRL 2-3 to 4-5) demonstrating the practical usefulness of engineered quantum states of light/matter to improve sensing or imaging and develop and demonstrate optimized quantum software for detection applications in real-world applications. They should leverage interdisciplinary expertise and join forces with metrology institutes or other relevant technical fields to further advance the limits of sensors sensitivity and resolution and to implement the best control protocols, statistical techniques (e.g. Bayesian, among others) and machine learning algorithms as appropriate.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms and contribute to the governance and overall coordination of the Quantum Technologies Flagship initiative.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-45: Quantum sensing and metrology for market uptake (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 4 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [19-21] million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6- by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States, Iceland and Norway.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| Link with other topics in other WPs | HE: “FPA for open testing and experimentation and for pilot production capabilities for quantum technologies” HORIZON-CL4-2021-DIGITALEMERGING-02-22 |

Expected Outcome: Projects are expected to contribute to mature quantum sensing technologies and devices (TRL 6-7) in different application sectors, with the goal of establishing a reliable, efficient supply chain including first standardisation and calibration efforts for rapid market uptake.

Scope:

Proposals should address the development of mature quantum sensing technologies and single or network-operating devices that have the potential to find a broad range of new applications including but not limited to transportation, precise localisation and timing, navigation, metrology, health, biology, security, telecommunications, RF sensing and processing, radars energy, electronics industry, construction, mining, prospection, aerospace, etc...

Proposals should demonstrate advanced prototypes of such sensing technologies that provide an unprecedented level of precision and stability, making new types of sensing, imaging and analysis possible. For rapid market uptake, they should target miniaturised, integrated, transportable quantum sensors and provide first plans for their further industrialisation and target customers through enhanced cost efficiency and user operability at higher TRL.

In order to achieve the above, proposals should include relevant actors from the whole value chain (from materials to devices and to system integration aspects). They may also include, wherever relevant: (i), activities and actors from metrology institutes that would provide measurement methods and/or standards, including for the development of quality assurance methods and for standardisation of the targeted quantum sensing technologies; (ii) strategies such as validation and benchmarking to other technologies in order to clearly identify quantum advantage and hereby assist successful and competitive market placement; (iii) the cooperation with complementary projects launched specifically in the area pilot capabilities (“FPA for open testing and experimentation and for pilot production capabilities for quantum technologies” HORIZON-CL4-2021-DIGITALEMERGING-02-22), to lower the threshold for industry via the transfer infrastructure provided by application labs, testbeds as well as fabrication and pilot line facilities being addressed under the synergetic FPA suggested above.

Finally, proposals should also cover: (any additional support they may receive from relevant national or regional programmes and initiatives, including the contribution to the governance and overall coordination of the Quantum Technologies Flagship initiative.. They should also contribute to spreading excellence across Europe, for example, through the involvement of Widening Countries.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-46: Quantum communication components for space applications (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR [27-29] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [27-29] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6- by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States, Iceland and Norway.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| Link with other topics in other WPs | DEP: DIGITAL-2021-QCI-01-INDUSTRIAL – Create a European Industrial Ecosystem for Secure QCI technologies and systems  DEFIS: call HORIZON-CL4-2023-SPACE-61, focusing on the development of “space QKD” and support for international standards in this field. |

The aim of the action is to prepare for the implementation of the space segment, and the provision of the EuroQCI’s first space-based services. Actions should be focused on supporting the pre-validation of the first generation of the EuroQCI space segment interconnected with the EuroQCI terrestrial segment, as a step towards the full deployment phase where the EuroQCI space segment will be fully integrated into the EU space-based secure connectivity initiative.

The final system architecture should encompass the development and deployment of advanced optical communication to interconnect the satellites (e.g EDRS/ HydRON) and a central mission operating centre for system in-orbit validation and testing. It should provide inputs for the certification and accreditation for different security levels of communication.

The final validation of the system should include the end-to-end testing and validation of the Space segment of EuroQCI and its interconnection with the terrestrial segment of the EuroQCI system.

The financing could be integrated into any investment intended to fund the EU space-based secure connectivity initiative currently under consideration.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-47: Quantum Photonic Integrated Circuit technologies (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 2 and 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [4-6] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States, Iceland and Norway.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |

Photonic Integrated Circuits (PIC) technologies on one side and quantum science on the other are the building blocks for development of Quantum PIC (QPIC) devices for quantum information processing, computation/simulation, communication, sensing or metrology. Photon-based approaches can address the huge challenge of implementing quantum processes in public infrastructures, challenging industry applications and compact everyday-life devices and products.

QPIC technology has great potentials to target several application fields, in particular, but not limited to, health care, communications, environment and security, and thus has high strategic significance and major implications for the European economy.

However, to implement QPICs, research challenges have to be faced throughout the value chain, going from materials, circuit design (including the support of EDA tools), manufacturing processes and technological platforms, to the realization and validation of reliable and robust demonstrators and prototypes, and their integration and packaging. Furthermore, quantum systems are typically large, complex and costly, hindering their scalability, and thus cannot be directly used in products.

QPIC technology can address these issues, paving the way for compact, high performance, cost-effective components, that will enable quantum technology to be introduced in the market.

**Expected Outcome**:

* To improve over existing PIC technologies in terms of performance, functionality, manufacturing process efficiency and reliability, integration, and packaging in a manner that facilitates scalable manufacturing.
* To demonstrate the technology capability in key enabling Quantum PIC technologies with high potential impact on the quantum technology Industry, including applications in quantum sensing, communications, computation and simulation,
* Preparing QPIC technologies for future Pilot Lines and Photonics hubs and open testing and experimentation facilities,
* Exploit the potential of QPICs for a digital, green and healthy future in Europe by providing critical components and systems for next generation applications, products and processes. Develop tools for efficient design and prototyping of QPICs.
* Secure Technological Sovereignty for Europe by maintaining leadership in QPICs
* Contribution to the objectives of Digital Transformation, Green Deal, Competitiveness and Economic Growth.

**Scope**:

Proposals will address technology (up to TRL 4-5) in key enabling PIC technology applied to market needs. Objectives include:

* Enhancement of PIC performance, e.g. ultra-low loss; ultra-low laser linewidth; ultra-high extinction ratio modulators and switches , extending spectral and optical power coverage, optical coupling interfaces.
* Incorporation of specific quantum functionality into PIC platforms, e.g. single photon and entangled photon pair generation, single photon and photon number detection , quantum memory elements.
* Multi-technology integration, e.g. incorporation of ion/atomic traps and relevant control electronics, superconducting detectors, nonlinear elements, integration of photonic readout into quantum computing and sensing devices employing other technologies (e.g. electronic, spintronic), relevant passive and active linear optical elements (e.g. modulators, shifters, switches etc.) to underscore a strategy for modular QPIC design.
* Development of PICs capable of operating at cryogenic temperatures, with low power dissipation and performance optimized in the context of the operating environment.
* Development of the most promising methods for QPIC fabrication in monolithic, hybrid or heterogeneous integration techniques for different functionalities together with an identification of the most advantageous platform materials, (e.g. derived from “classical” PIC technologies such as Si, SiO2, Si3N4, InP, LiNbO3, Si-on-insulator, LiNbO3-on-insulator, hybrid platforms, etc. etc. etc.).
* Assembly and packaging of PICs, taking the specific challenges of quantum systems (environment, temperature, stability, visible and ultraviolet wavelengths requirements, vacuum integration) into account and including integration of complementary and ancillary technologies (e.g. microelectronics) where required
* Miniaturization of previously non-scalable quantum photonic systems by implementing them in PIC form.

Proposals should identify applications in quantum sensing, communication, computation and simulation. Proposals should test and evaluate the developed Quantum PIC technologies in the context of such specific applications though trials at systems level in a representative laboratory or an operational environment.

These technologies should be developed in a manner to facilitate scalable manufacturing. Proposals should address IP management strategy and collaboration with European industry and SMEs, in particular in the context of establishing relevant European industrial manufacturing capabilities.

Collaboration with the Quantum Flagship initiative and the photonics partnership is crucial to be able to merge knowledge and experience in photonic technologies and quantum science.

In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

## **European Leadership in Emerging and Enabling Tech.**

HORIZON-CL4-2023-DIGITAL-EMERGING-01-11: low TRL research in micro-electronics and integration technologies for industrial solutions (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 3 and 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [30-40] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 1-2 and achieve TRL 3-4 by the end of the project – see General Annex B. |

Expected Outcomes: Projects are expected to contribute to the following outcomes:

* Innovative semiconductor and micro-nanoelectronic systems design concepts supporting very low energy consumption, integrated security, connectivity, sensing, actuating and embedded functions suited to mixed analogue/RF and digital circuits.
* Alternative[[128]](#footnote-129) semiconductor manufacturing process technologies able to sustain in the mid- and long-terms the fast pace evolution of device performance, miniaturisation and cost, while reducing environmental footprint.

Very advanced packaging solutions aiming at extreme miniaturisation and integration, e.g., with RF, mmW or THz communication, power management, active/passive integration

Scope:

Proposals should:

* Address low-TRL research with high potential not yet demonstrated in the design, fabrication process and/or packaging segments of the micro-nano-electronics and integration technologies value chain.
* Innovation focus can be on materials, physic concepts, device architecture or integration technologies.
* Provide a projection of the expected gains and main figures of merit of the proposed approaches.

Multi-disciplinary research activities should be address along part of the value chain from materials, processes, equipment, metrology, back-end processing to packaging, integration and tests.

International cooperation is encouraged, especially with leading semiconductor countries (e.g. Japan, South Korea, Taiwan) in support of EU policies (and outcome of the CSA on Int’ cooperation in SC).

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

### **HORIZON-CL4-2023-DIGITAL-EMERGING-01-12: Adaptive multi-scale modelling and characterisation suites from lab to production (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 5 and7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 22 million. |
| *Technology Readiness Level* | Activities are expected to start at TRL 3 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

To support the green and digital industrial transition, there is the need to develop innovative routes to accelerate the design and production of new advanced materials, improving the circular economy and developing alternative feedstocks to support the EU strategic autonomy throughout value chains. Industrial research for materials from laboratory to production requires the extension of current knowledge on materials behaviour to the entire value chain.

To tackle this challenge, we can build on European leadership in recent advances in multi-scale modelling and characterisation.

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Enable industry to more effectively develop and work with new advanced materials by building on digitally integrated modelling and characterisation along value chains
* Accelerate the materials innovation process by allowing a better interpretation of available experimental data and by providing more effective guidance on further experiments
* Overcome gaps in modelling and characterisation capabilities targeted at different stages in materials and production value chains by means of adapted and benchmarked suites covering all steps from materials design (including several scales, e.g. from molecular to macroscale) to product development.
* Achieve a strong European materials ecosystem (\*) through platforms allowing a systemic use of tools and capabilities including materials modelling, characterisation, robotics, data documentation, ontologies, artificial intelligence and machine learning, which are orchestrated to accelerate the design, development and application of chemicals, materials and related processes and manufacturing.

Scope: The development of novel advanced materials requires a wide and complex range of trusted information on materials and process behaviour, along the entire lifecycle of a material, reaching far beyond the data sets generally available to industry currently. In particular, an approach is required that provides end users with highly flexible, adaptable modelling and characterisation tools as a source of data and knowledge in critical application fields. Subsequently, the validation of the developed methods will help to establish trust of the industry in these methods. This will also support the emerging need for adopting alternative materials as feedstock compliant with the high qualification standards and strengthen the strategic autonomy and resilience of EU’s industry.

Proposals should address the development of benchmarked suites of models and characterisation methods for critical application fields in strategic innovation markets (\*) covering the different stages in materials and industrial production value chains and circularity.

In particular, proposals should address all of the following:

* Develop physics-based modelling methods that provide the capabilities to virtually characterise materials and enhance the interpretation of the results of particular characterisation methods and that can predict trends to guide and refine experiments.
* Develop accurate, validated physics-based models, in areas where these capabilities are a bottleneck, by utilising a combination of characterisation and machine learning to generate material and application specific parameters and equations (called materials relations, ref. CWA 17284 (\*\*)).
* Develop multi-scale and multi-technique characterisation, combined with respective multi-scale modelling and machine learning to
  + improve the reliability and quality of data
  + understand scaling relationships in the behaviour of advanced materials.
  + develop complex structure-property correlations in advanced materials
  + ensure complete coverage of conditions in industrial environments
* Demonstrate the functionality of the suites for the development of certain advanced materials for the green transition.

Proposals submitted under this topic should include a business case and exploitation strategy, after the end of the action especially for the validation and certification, as outlined in the introduction to this Destination.

Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

(\*) <https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/advanced-materials-2030-manifesto.pdf>

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[https://www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/cwa17284\_2018.pdf](https://urldefense.com/v3/__https:/www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/cwa17284_2018.pdf__;!!DOxrgLBm!U7QxVGvBdVcAoq2tXGPyGIP7-FHBAcIXYzDpu5IlDLnUrr6QD3IomhfsX1Rpq-P_GOV-p3J_$)

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| **The following topic is likely to be tackled within the EIC with whom it is being discussed. It is being put here for transparency pending final decision for EIC.** |

HORIZON-CL4-2023[2024]-DIGITAL-EMERGING-01-13: Chip-scale optical frequency combs for data communication, biosensors and mobile atomic clocks (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR x and x million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR xx million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL x and achieve TRL y by the end of the project – see General Annex B. |

Expected Outcomes: Projects are expected to contribute to the following outcomes:

* Develop technologies for frequency combs for applications which requires multiple frequencies of coherent laser light.
* Mature the state of chip-scale platforms to establish frequency combs widely, across all spectral regions with integrated photonic technologies
* Develop concepts for new industrial applications exploiting the precision of optical frequency combs such as
  + Integrated multi-channel light sources for optical communication in data-centers
  + Highly efficient sensors that measure mid-infrared molecular spectra
  + optical atomic clocks on a chip

Scope:

Photonic integrated frequency combs are a novel class of on-chip frequency combs, generated by nonlinear parametric gain. In contrast to laser frequency combs, they are compact, offer large mode spacing that matches the telecommunication grid, and can be integrated with other functionality and importantly, are compatible with wafer scale integration - i.e. semiconductor volume fabrication.

Over the past decade photonic integrated frequency combs have made remarkable advances: they can now be operated battery powered, and integrated with III-V gain media, and have been shown in numerous novel system level applications, ranging from terabit per second coherent communication, parallel LIDAR, to neuromorphic computing, to microwave generation or astro-physical spectrometer calibration. New applications are emerging in Raman spectroscopy and bio-sensing for e.g, medical diagnostics, environmental sensing and food production.

The proposal should address:

* The development of novel nonlinear platforms for chip-scale frequency combs
  + with higher conversion efficiencies
  + with extensions to new wavelength ranges
  + with integration options for other functional elements
  + compatible with wafer scale manufacturing
* Improve the understanding of the light states in driven nonlinear systems

Use of new nonlinear materials such as Gallium Phosphide, Lithium Niobate and others may be considered as well.

# **5. Destination: Open strategic autonomy in developing, deploying and using global space-based infrastructures, services, applications and data**

Open strategic autonomy in conceiving, developing, deploying and using global space-based infrastructures, services, applications and data, including by reinforcing the European independent capacity to access space, securing the autonomy of supply for critical technologies and equipment, and fostering the European space sector competitiveness.

In this Work Programme, several Topics are particularly targeting start-ups and SMEs. This is the case of the Cassini section of course, but also of Future Space Ecosystem and Enabling Technologies and of Copernicus-based applications for businesses and policy-making, for example.

In this Work Programme as well, several Actions and Topics will contribute to the upcoming Secure Connectivity initiative which has been proposed by the Commission on 15 February 2022. This is the case of the GOVSATCOM actions related to Secure Connectivity infrastructure and upstream R&D under Other Actions and of the Quantum Communication Technologies for space systems Topic, focused on quantum QKD cryptography.

Attention has been paid to formulate Topics enabling also smaller projects, with sufficient openness in the formulation of the scope, for which small and agile consortia should be able to demonstrate their capabilities to shorten times to market.

## 5.1 Competitiveness

HORIZON-CL4-2023-SPACE-01-11: End-to-end Earth observation systems and associated services (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 7 and 11 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3/4 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Article 22.5* | No |
| *Lump-sums* | Yes |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Key Policy Trackers* | Climate Action 40%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: The expected outcomes of this topic will enable flexible satellite Earth-observation end-to-end systems as a strong subject to answer the new trends of a very dynamic market environment with high potential. Competitiveness will be strengthened by providing growing capacity per system, as well as flexibility supported by modular and COTS-based systems and their submodules, their reconfigurability and reusability. The agility to face uncertainties and market evolutions and improving system availability and latency to deliver high-quality experience to end-users should be addressed.

Projects are expected to contribute to one or several of the following outcomes:

* Achieve and maintain the worldwide leadership for Earth Observation system
* A flexible and competitive end-to-end system demonstration (at the minimum, breadboards realisation and validation on ground, in a representative E2E environment by 2027/28);
* Short to medium term disruptive development and maturation of key technologies (up to TRL 6) for high performance Earth observation;
* Contribute to EU non-dependence for the development of Earth-observation technologies;
* Contribute to making Europe a net-zero emitter of greenhouse gases (European Green Deal).

This topic will contribute to develop and deploy global space-based services, applications and data, and therefore contributes to foster the EU's space sector competitiveness, as stated in the expected impact of this destination.

Scope: The areas of R&I, which need to be addressed to tackle the above-expected outcomes are:

1) R&I for Earth observation based on a network of small satellites with innovative capabilities, e.g. high revisit times, high reconfigurability, enhanced autonomy, high spatial resolution, including for video, seizing the full innovation potential of low cost and/or disruptive approaches while at the same time considering collision avoidance and end-of-life operations.

2) R&I on Satellite Data Management and Processing including image processing for end-to-end performance improvement (also w.r.t. power consumption, e.g. using AI, simplification of data management, data fusion, advanced processing units, mass memory) and on infrastructures and networks focussing ground processing and virtual network functions (e.g. inter-operability, massive data management, cloud processing, cybersecurity).

3) R&I to identify, develop and implement AI and industry 4.0 means fostering digitalisation (e.g. virtual design, digital twins, virtual testing, simulators) for Earth observation including software validation and verification in order to enhance overall end-to-end system performance, increase efficiency and reduce development and AIT time and costs in order to attain *Rapid Development, Production* and *Assembly Integration and Testing (AIT)* processes and operations support in satellite life cycle.

Proposal should address only one area. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

Proposals are expected to promote cooperation between different actors (industry, SMEs and research institutions) and consider opportunities to quickly turn technological innovation into commercial use in space.

Proposals under this topic should explore synergies and be complementary to already funded actions in the context of technology development at component level. In particular, the topics: Critical Space Technologies for European non-dependence (H2020 SPACE-10-TEC-2018-2020, H2020 COMPET-1-2014-2015-2016-2017); Earth observation technologies (H2020 COMPET-2-2017, H2020 EO-3-2015, H2020 SPACE-14-TEC-2018-2019). Furthermore, proposed activities should be complementary to national activities and activities funded by the European Space Agency (ESA), while contributing to EU non-dependence and strengthen competitiveness.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-SPACE-01-12: Future Space Ecosystem and Enabling Technologies (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 13 and 17 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 3 and achieve TRL 4/5 by the end of the project – see General Annex B.  Activities addressing area 3 of the call topic are expected to achieve  TRL6/7 by the end of the project – see General Annex B |
| *Article 22.5* | No |
| *Lump-sums* | Yes |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Key Policy Trackers* | Climate Action 40%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: Enable the industrialisation and new services in space by intelligent solutions and competitive concepts, exploiting synergies with terrestrial sectors and cultivating an “AppStore”, Open-Architecture and Standardisation mentality towards quickly developed, sustainable, highly automated, flexible and economical viable space systems and infrastructure.

Enabling technologies shall improve space systems and satellites’ flexibility and cost-efficiency, increase sustainability and accessibility, introduce mass-customisation and cooperative design as well as simplify and optimise operations. This is needed to access a large portfolio of promising commercial applications in space and on ground. Those technologies can be used for missions addressing any type of applications (on-orbit servicing, satellite telecommunications, EO etc.). The list of enabling technologies includes but is not limited to:

* Electric Propulsion
* Robotics incl. Hardware, Software, Control
* Automation; Hardware, assets & processes
* Artificial Intelligence
* Software factory, automatic code generation

All technologies can be used/researched especially in combination with standardisation, modularisation and digitalisation. The emphasis of this activity is enabling efficient in-space services such as maintenance, assembly, manufacture, logistics, warehousing and recycling.

This topic aims at increasing the effort for further developing and space qualifying innovative, game-changing technologies, maturing key technology building blocks as well as proposing new applications and services for the future space ecosystem.

Each project is expected to contribute to one or several of the following outcomes:

* A future space ecosystem, fostering the industrialisation and business in space as well as supporting scientifically meaningful missions by using synergies with terrestrial sectors;
* A sustainable, highly automated, flexible and economical viable space infrastructure, building on technologies and concepts for a circular economy in space, e.g. plug-and-play spacecraft functionality introducing recycling/re-use of spacecraft modules/functionalities;
* New technologies and approaches for future space systems, application and services such as on-orbit services (OOS) including maintenance, assembly, manufacturing, highly-automated re-configuration, recycling, logistics, warehousing, etc.;
* Support activities intending to allow in-orbit demonstration/validation (IOD/V);
* Short to medium term disruptive development and maturation of key technologies (up to TRL 7);
* Contribute to EU non-dependence for the development of Space technologies.

This topic will contribute to, in the medium to long term, developing, deploying global space-based services and contribute to fostering the EU's space sector competitiveness, as stated in the expected impact of this destination.

Scope: The areas of R&I, which need to be addressed to tackle the above expected outcomes are:1) R&I on generic building blocks technologies for electric propulsion systems considering paradigms relevant for industrialisation (e.g. miniaturisation, scalability, flexibility, cost reduction). The activities should aim at anticipating and adapting to future market and application needs in a future space ecosystem (e.g. on-orbit logistic services, maintenance, assembly, recycling, de-orbiting, debris removal)..

2) Development and maturation of technologies and concepts with a clear application, pathway to applications and business sustainability in mind. Applications domains can be for example:

* Innovative approaches for operations, e.g. multi-orbit constellations, upgrade/re-configuration of existing space assets for multi-mission purposes
* Next generation of services, e.g. satellite life extension, maintenance/upgrading, assembly, recycling, logistic or warehouse services
* Enabling technologies that contribute to a sustainable, commercially viable space infrastructure, space debris mitigation and on-orbit services
* Serial production and manufacturing concepts of reliable small satellites, industry 4.0 means to enhance flexibility, allowing mass-customization, and fostering use of commercial-off-the-shelf (COTS) products/components
* Software for mission control, cloud-based data rooms, improving ground-based reception equipment (both ground stations and transmit/receive antennas for mobile applications).
* New hardware and software approaches to shorten development, test and integration of sub-systems/equipment/components or to allow re-use/recycle platform functionalities in space by making use of e.g. novel design paradigms such as standardised, functional satellite modules.

3) R&I on functional satellite modules (Orbital Replaceable Units to deliver new/enhanced functionality to a satellite) based on the approach developed in the call HORIZON-CL4-2021-SPACE-01-12. Following that approach, the main outcome of this R&I activity is the development, integration, testing and delivery of a flight model by the end of this project of at least two functional satellite modules to upgrade the satellite platform of the orbital demonstration mission (HORIZON-CL4-2022-SPACE-01-11) with new functionalities. The modules will be connected to the platform by using selected pre-existing standard interfaces[[129]](#footnote-130) (plug-and-play concept). Further reference is given in a technical guidance document[[130]](#footnote-131).

Proposals should clearly indicate and focus on one of the above-mentioned areas, but this does not preclude that a proposal contributes to other areas if deemed beneficial to support the creation of new in-space services. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

Projects are expected to promote cooperation between different actors (industry, SMEs, Start-ups, research institutions and academia) and consider opportunities to quickly turn technological innovation into commercial space usage.

Proposals should explore relevant and promising solutions derived in Horizon 2020 activities, especially project results from the Strategic Research Clusters Space Robotics Technologies[[131]](#footnote-132) and Electric Propulsion[[132]](#footnote-133).

Owing to the level of the expected EU contribution, it is recommended to set up a compact consortium with clear and complementary roles.

Proposals under this topic should explore synergies and be complementary to already funded actions in the context of technology development at component level.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-SPACE-01-13: Future Space Ecosystem: Management and Coordination Activity (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 2 and 3 million. |
| *Type of Action* | Coordination and Support Action |
| *Technology Readiness Level* | Not applicable |
| *Article 22.5* | No |
| *Lump-sums* | Yes |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Key Policy Trackers* | Climate Action 0%  Digital: 0%  Biodiversity: 0% |

Expected Outcome: Not only dedicated technology is required to foster future business in space, but also a sustainable framework, providing enough flexibility to let businesses emerge and grow in the field of OOS. Therefore, a targeted development and operation of the European Operations Framework (EOF)[[133]](#footnote-134) including the update of the EOF Guidelines for On-Orbit Services (OOS) and evolution of the Future Space Ecosystem (FSE) roadmap is necessary. The roadmap shall identify and describe pathways to innovative and promising applications and services in the fields of on-orbit services. It shall consider new space approaches, enabling technologies (e.g. electric propulsion, robotics, AI, high-performance and reliable avionics) as well as continuous market and trend analyses. Defined actions will enhance and facilitate synergies with terrestrial sectors and ensure complementary and coherence with ongoing or future activities in ESA, Member States, Associated Countries and other relevant stakeholders.

Expected Impact:

* Coherent guidelines for On-Orbit Services (e.g. life-extension, maintenance, assembly, logistics, etc.) supporting EU actors implementing their business ensuring consideration of sustainability, safety and competitiveness.
* Efficient EOF framework that contributes to a coordinated position of the European parties in OOS to make better use of R&I and to strengthen future space ecosystem.
* Roadmap focussing on promising in-space services, that take advantages of enabling technologies and of synergies between cluster 4 destinations and activities for the future space ecosystem maximising the market opportunities and benefits.

Scope: Acceptable rules, standards and methodologies need to be put in place in order to ensure the continuous safe use of space and space-based assets. The lack of standards in terms of technology and processes in OOS considering not only sustainability and safety but also supporting competitiveness impacts both stakeholders on the demand and on the supply side. Therefore, this coordination and support action shall

* consolidate the European Operations Framework (EOF) and support collaboration among all relevant stakeholders;
* ensure the continuity EOF and generate regular updates of guidelines & principles for OOS;
* support further regulation (i.e. STM), licensing and norming activities done by appropriate instances ;
* identify and select the most promising technologies (game-changer/key technologies) and create a pathway for quick maturation and space qualification.

Furthermore, in close collaboration with the European stakeholders this support action shall

* identify and describe pathways to innovative and promising applications and services as elements in the further developed FSE roadmap, using feedback of relevant stakeholders (e.g. through EOF) and taking into account consider new space approaches, enabling technologies (e.g. electric propulsion, robotics, AI, high-performance and reliable avionics) and using market and trend analyses; complementary to ESA and national agencies roadmaps shall be ensured, synergies with the other activities of Cluster 4, Industry and digitalisation will be identified, considered and exploited where suitable;
* shall monitor the project(s) of other calls related to the Future Space Ecosystem in order to support decisions regarding programmatic and strategy questions in the field.

The overall objective is to maximise the business opportunities through means of modularisation, standardisation, digitalisation and new industrial processes and production tools.

Target-oriented dissemination activities should be implemented to facilitate support of EU stakeholders with regards to OOS and to promote EU Space R&I activities in the future space ecosystem.

Active participation of industrial actors including SMEs in the consortium is strongly recommended.

HORIZON-CL4-2023-SPACE-01-14: Management and Coordination Activity for the Space Partnership (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 1 and 2 million. |
| *Type of Action* | Identified beneficiary action (Coordination and Support Action)  Beneficiaries are: Eurospace, SME4Space, EARTO Space, ESRE, EASN |
| *Technology Readiness Level* | Not applicable |
| *Article 22.5* | No |
| *Lump-sums* | Yes |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Key Policy Trackers* | Climate Action 0%  Digital: 0%  Biodiversity: 0% |

Expected Outcome: Space is a strategic sector for the European Union. The Space Partnership ‘Globally competitive Space Systems’ aims at delivering key contributions to the objectives set by the Space Strategy for Europe. It will contribute to foster the global competitiveness and shortening the time-to-market of EU space systems, to reinforce European capacity to access space and to accelerate the pace of innovation, and it will develop and enable the uptake of the next-generation space technologies. By 2030, the Partnership is expected to largely contribute to the development of competitive end-to-end systems for satellite communication and Earth observation and smart technologies for EU launcher systems. Thus, the Partnership activities strengthen key assets for the EU policies on climate, environment, transport, agriculture and secure society.

Therefore, this action aims at supporting the successful operation of the Space Partnership. Main tasks of the day-to-day business of the partnership will be on stakeholder consultation, roadmap and activities definition, dissemination activities and community building.

Scope: This action comprises the following main tasks:

* Support the successful setup and initial operation of the Space Partnership which will demonstrate principles of transparency, openness and inclusiveness. The partnership association or the associations of the founding partners should be open to new partners.
* Contribute to the introduction of an open and transparent process for consulting stakeholders including Member States and Associated Countries on the design of the roadmaps. Dedicated actions in relation to the adequate participation of entities from widening countries should also be considered.
* Update and maintenance of the SRIA for the Partnership
* Dissemination of Partnership activities and support of the community building.

## 5.2 Access to Space

HORIZON-CL4-2023-SPACE-01-21: Low cost high thrust propulsion for European strategic space launchers - technologies maturation including ground system tests (RIA)

Restrictions of Article 22.5 will apply

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| **Specific conditions** | | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is between EUR 17 and 23 million. | |
| *Type of Action* | Research and Innovation Actions | |
| *Technology Readiness Level* | Activities are expected to start at TRL 3/4 and achieve TRL 7 by the end of the project – see General Annex B. | |
| *Lump-sums* | Yes | | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. | |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States + Norway and Iceland under Protocol 31 of the EEA Agreement (and other associated countries, provided certain conditions are met).  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. | | |
| *Key Policy Trackers* | Climate Action 0%  Digital: 0%  Biodiversity: 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

Contribution to the overarching objective of launch cost/price reduction by 50% by 2030 (with respect to A6/VegaC cost/price 2021 economic conditions), for the benefit of EU Space programmes implementation and going towards reinforcing EU‘s independent capacity to access to space.

* Innovation acceleration of enabling technologies (maturing, prototyping, on ground tests)
* Selection of most promising technologies for cost-reduction possibilities in the current European launchers
* Matured technologies up to TRL 5-6 by 2025, including prototyping and on ground tests at subsystem level
* Cost reduction investigation and demonstration.

These outcomes will contribute to enhance EU strategic autonomy and sector competitiveness, in line with the Expected Impact of the destination.

Scope: Cost reduction and improving flexibility of European launch systems are the main challenges in order to foster European industry competitiveness on the global market.

The propulsion systems represent a significant part of launch system costs. It is necessary to mature new or optimised low cost effective (lower number of parts, better operability), high performance (high thrust to weight ratio, high specific impulse) and green propulsion concepts, technologies and propellants for high thrust engines.

The activities should address:

* Maturation of enabling technologies, building blocks, tools and processes including maintenance/overhaul and safety, up to TRL5/6 and subsystem tests including prototyping and integrated tests at subsystems level by 2025;
* Demonstration of the above technologies by subsystems and engine on-ground demonstration tests by 2026 to reach TRL 7.

The matured technologies, building blocks, tools and processes should be applicable to strategic launchers able to launch EU Space Programme components, with the objective of enabling operational capacities by 2030 and preferably earlier for current launch solutions. The tests should be appropriate to this objective.

The proposed activities must also support EU non-dependence objective and include the assessment of costs reduction investigations and test results towards the overarching objective mentioned in the expected outcomes.

The activities will address one or several of the following areas:

* low cost propulsion,
* throttability,
* controllers taking advantage of AI
* reduced number of parts with extensive application of Additive manufacturing, or new composite technologies
* maintenance/overhaul,
* associated fluidics.

The activities should include as many as technologies possible in each area to maximise the number of matured technologies to be submitted to integrated tests at subsystem level and integration of subsystem (all technologies together) for engine firing tests by 2026.

All the activities should be complementary and coherent with the ESA on-going or future activities in particular those decided at the last ESA Ministerial held in November 2019 and planned to be decided at the ESA Ministerial planned in November 2022.

Proposals should provide all IPR dependencies and dependencies with other on-going activities, and detail the implementation, the reporting and the organisational as well as steering measures that will be taken to ensure that the proposed activities can be implemented and can achieve all the expected outcomes within the project schedule and budget.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-SPACE-01-22: New space transportation solutions and services (RIA)

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 20 and 26 million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3/4 and achieve TRL 5/6 by the end of the project – see General Annex B. |
| *Lump-sums* | No |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States + Norway and Iceland under Protocol 31 of the EEA Agreement (and other associated countries, provided certain conditions are met).  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| *Key Policy Trackers* | Climate Action 40%  Digital: 0%  Biodiversity: 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Contribute to EU Green Deal objective through the reduction of the environmental impact of space transportation and to be prepared for the upcoming REACH regulations, especially with respect to the use of hydrazine and its derivatives, focussing on commercial market as a driver for business growth.
* Contribute to expand commercial space transportation offer and services with new space transportation solutions. The objective is to contribute to double the accessible new space transportation service market to European industry by 2030.
* Design and performance studies as well as business cases (demonstration of economical viability).
* Matured technologies up to TRL5-6 including functional and qualification test on ground.

These outcomes will contribute to enhance the sector competitiveness, in line with the Expected Impact of the destination.

Scope: There are emerging opportunities in space transportation out of which some are recently started to being seized by European actors characterised by new uses of space (e.g. small satellites, larger constellations and payload recovery) new destinations (e.g. direct GEO, re-entry from LEO).

The expected proposed activities should contribute to the maturation up to TRL5-6 of enabling new technologies and subsystems (including common building blocks) in the field of green propulsion, micro launchers and associated launch facilities, kick stage, orbital propulsion and distancing, attitude and landing, re-entry solutions, smart satellite deployment systems/dispensers, for space transportation including also new routes up to Lunar orbit or surface.

The maturation could go up to subsystem and system [[134]](#footnote-135) level technology demonstration and must include at least one of the following areas and linked technologies:

* Technologies for recovery of Space Transport vehicles elements:
  + Technologies to be matured in order to allow the re-entry of launcher elements through the entire atmospheric flight domain from in-orbit up to soft landing on earth: Controlled hypersonic flight, the highly dynamic decent and landing maneuver, aerodynamics and aerothermal design, attitude control system, actuators and propulsion system, advanced GNC design, propellant sloshing and system transient dynamics, low cost re-entry protection system, low cost, low weight and high performance structures.
  + Technologies enabling recovery, high reuse and limited refurbishment need of launcher fairing: low cost and scalable concept design, structure with early consideration of manufacturing, pyrotechnic / distancing devices, recovery means solution, demonstrators for recovery and maintenance/overhaul.
  + Technologies maturation for micro launcher first stage and booster stage. reusability concepts that have a strong potential for cost reduction.
* Space Transportation technologies in support to In-orbit servicing systems:
  + Technologies allowing the in orbit reuse of a green and sustainable cryogenic elements for multiple operations and missions in-orbit: green propulsion and green Kick stage, versatile operation of cryogenic upper stages as on-orbits platforms, cryogenic propellant management for long duration missions, High multi-restart capability for in-space cryogenic engines, in-orbits cryogenics tanks, electric pumps for in-space propulsion, in-space refuelling for cryogenic systems, interface and connection to in-space solutions, innovative low cost materials for in-space applications, attitude control systems (RACS), advanced avionics, GNC.

All the activities should be complementary and coherent with the ESA on-going or future activities in particular those decided at the last ESA Ministerial held in November 2019 and planned to be decided at the ESA Ministerial planned in November 2022.

Proposals should provide all IPR dependencies and dependencies with other on-going activities, and detail the implementation, the reporting and the organisational as well as steering measures that will be taken to ensure that the proposed activities can be implemented and can achieve all the expected outcomes within the project schedule and budget.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2024-SPACE-01-23: Modern, flexible and efficient European test, production and launch facilities (RIA)

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 8 and 12 million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3/4 and achieve TRL 5 to 7 by the end of the project – see General Annex B. |
| *Lump-sums* | No |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States + Norway and Iceland under Protocol 31 of the EEA Agreement (and other associated countries, provided certain conditions are met).  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| *Key Policy Trackers* | Climate Action 0%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Contribution to the overall objective of launch cost/price reduction by 50% by 2030 (with respect to A6/VegaC cost/price 2021 economic conditions), for the benefit of EU Space programmes implementation and towards reinforcing EU‘s independent capacity to access to space.
* Contribute to expand commercial space transportation offer and services with new space transportation solutions. The objective is to contribute to double the accessible new space transportation service market to European industry by 2030.
* Improve cost efficiency of European test, production and space launch facilities.
* Matured technologies, standardised technology for improving cost efficiency, interoperability of access to space ground facilities in EU, ground assets portability to speed-up deployments.

These outcomes will contribute to enhance EU strategic autonomy and sector competitiveness, in line with the Expected Impact of the destination.

Scope: Cost reduction and improving flexibility of European launch systems are the main challenges in order to foster European industry competitiveness on the global market.

Europe needs to improve the cost efficiency of the access to space ground facilities and of launch systems production and operations for the strategic launchers essential for the implementation of EU space programme. It could benefit from the industry 4.0 transformational wave, which has the potential to exploit digitalisation and advanced data management for lowering the cost of low production rate facilities and further improving quality.

In addition, EU access to space ground facilities needs to become interoperable allowing to decrease the launch service costs.

In continuation of the work initiated during WP21-22, the activities will address one or several of the following listed domains under a) and/or b):

a. Multi sites flexible industrial platform:

Feasibility study and maturation of key technologies in representative conditions, including cost benefits assessment of a flexible platform as a tool for existing and future European space launcher products, to enable a cost-efficient approach including existing Manufacturing Assembly Integration and Testing capabilities as design constraints, to increase economical robustness against variable production rates in the rocket industry and to optimise transfer from existing to new launcher productions.

To explore, including from other industrial sectors, the use of a value-stream mapping (including the material- and information flow) in the field of Design to Manufacturing, Integration, Maintenance and Operation capabilities including improvements based on advanced data management and Artificial Intelligence. Maturation of technologies, including for reusable parts of the launch systems.

b. Develop standardised and cost-effective innovative technologies to improve cost efficiency of Test and Launch facilities, their interoperability and compatibility/attractiveness for new users, including one or several of the following domains:

1. modern data handling, data processing, diagnostic techniques
2. eco-friendly technologies,
3. automation and innovative controls,
4. mobile telemetry systems, mobile payload preparation facilities,
5. vacuum simulation test facilities,
6. security and safety

The maturation will go up to an incremental demonstrations of key technologies.

In addition solutions for improving flexibility (for new actors and concepts), configurability and interoperability of European test and launch facilities, including existing operational facilities, will be address:

For launch facilities, activities shall address different standard and means related to launch range, operations, communication, safety (this may also include safety equipment to be installed on-board: development and/or tests)… The objective is to allow to operate multiple-launchers from different launch sites in order to minimize the impact on their definition.

For test facilities, activities shall address analysis and means with regards to flexibility for multiple/green propulsions and adaptation of engine test capacities to reach modular and smart engine test simulator.

The maturation will go up to an incremental demonstrations of key technologies.

All the activities should, be complementary and coherent with the ESA on-going or future activities, in particular those decided at the last ESA Ministerial held in November 2019 and planned to be decided at the ESA Ministerial planned in November 2022. Proposals should provide all IPR dependencies and dependencies with other on-going activities, and detail the implementation, the reporting and the organisational as well as steering measures that will be taken to ensure that the proposed activities can be implemented and can achieve all the expected outcomes within the project schedule and budget.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

## 5.3 Copernicus services evolution

HORIZON-CL4-2023-SPACE-01-31: Copernicus for Atmosphere and Climate Change, including CO2

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 7 and 10 million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL5-6 by the end of the project – see General Annex B. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  The granting authority can fund a maximum of three projects. |
| *Lump-sums* | Yes |
| *Key Policy Trackers* | Climate Action 100%  Digital: 40%  Biodiversity: 40% |

Expected Outcome: Project results are expected to contribute to the following expected outcomes:

* Enhanced quality and enhanced efficiency of the Copernicus Atmosphere Monitoring and Copernicus Climate Change services to respond to evolving policy and/or user requirements and to technological developments
* Continuation of the set-up of the new Copernicus element for the monitoring of anthropogenic CO2 emissions
* Development of efficient and reliable new product chains, calling for new paradigms in data fusion, data processing and data visualisation and implementing Big Data & analytics modern solutions to handle more high-volume satellite data sets and product sets. The baseline is to preserve continuity of what has been achieved while keeping the service modern and attractive through.
* Development of new algorithms and processing chains preparing for the use of new types of space observation data (being from new Sentinels, other contributing missions or ESA Earth Explorer missions) in order to allow the development of new products or the improvement of existing ones.
* Development of innovative and robust methodologies for characterising the likelihood of occurrence of compound and/or sequences of and/or cascading hazardous events in the present and in future climate
* Development of an appropriate framework for attributing compound, sequences and/or cascading events to climate variability and change.

Scope: The R&I area is:

* Copernicus Atmosphere Monitoring Service evolution: the objective is to develop new and advanced modelling and data assimilation in CAMS global and regional systems in order to keep modelling and data assimilation aspects at the international state-of-the-art and benefit fully from ground-based and satellite observations, in particular from active remote-sensing (lidars). In addition new methods to advance substantially in the modelling of secondary aerosols and their interlinks with gas phase chemistry.  
  With an integrated modelling approach, the integration of new observational data becomes a driver for further enhancement and improved realism of the already existing production chains, assimilation systems and coupled models. The development of advanced processing and modelling techniques, as well as the exploitation of new sources of data, will be targeted to create new products or significantly improve the quality and performances of existing elements-components for the benefit of users. The projects should take into account the existing service and clearly define to what extent the service will be improved with new elements or products, including the use of enhanced models, algorithms, tools and techniques to generate new products.  
  The main output of the project should be tools and methodologies that can be readily transferred for improving aerosol representation in CAMS operational global and regional systems. The proposal should develop activities that will improve the quality of the aerosol variables in the CAMS global and regional analyses, forecasts and reanalyses, as well as of the CAMS solar radiation products.
* Copernicus Climate Change Service evolution: the objective is to develop innovative methodologies to characterise compound and cascading extreme weather events, including determining the potential frequency, intensity and impacts of these events in a changing climate. The proposal should underpin the creation of tools to monitor these events, attribute them to climate variability and change and, whenever possible, project changes in their likelihood.  
  Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service. The research should be performed using existing Copernicus datasets for identifying natural hazard events at continental (Europe) and global scales, and existing methods, models (including local), tools and observations available at the different Copernicus Services. Examples of high-impact weather-driven natural hazards include, but are not limited to, floods, droughts, wildfires, storm surges, heatwaves and their impacts.  
  The proposed research and development should be modular and scalable and the transfer of research results to possible operations should receive active attention during the project to strengthen the readiness for an operational deployment in the future. Further details are highlighted in the Guidance document.
* Research activities to develop new and innovative methods to improve mass conservation estimations in transport models of atmospheric CO2 and other relevant tracers in the CAMS/CO2MVS capacity to accurately estimate CO2 emissions and to improve the numerical schemes used in the CO2MVS capacity systems based on accurate metrics.   
  Copernicus Anthropogenic CO₂ Emissions Monitoring & Verification Support (MVS) capacity: The main objective is to perform R&D activities identified as priorities for the Copernicus CO2MVS capacity as identified by the European Commission’s CO2 monitoring Task Force. The activities should support the further development of the foreseen European operational monitoring support capacity for anthropogenic CO2 emissions. These activities should complement or follow-up on the activities within the H2020-funded CO2 Human Emissions (CHE) project and the Prototype system for a Copernicus CO2 service (CoCO2) project. The activities, as described in the Guidance document, should address a series of scientific and critical system design issues, which were defined following outcomes of the CHE project and based on recommendations from the CO2 monitoring Task Force. More generally, this action should support the development of an integrated support capacity, enabling European experts to collectively share their knowledge and join forces on the multiple fronts required to develop such a system with operational capabilities. The activities should fulfil the technological and scientific requirements for the development of this European operational capacity, to further improve the prototype system to better meet user requirements and to exploit synergies with other Copernicus services.

Proposals should address only one area. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service within the period 2021-2027. The proposed research and development should be modular and scalable. The activities of the project should also contribute to the objectives set by the Group on Earth Observation and outcomes and relevant results of the project should be promoted also at international level through the Global Earth Observation System of Systems (GEOSS).

The projects should provide a proof-of-concept (e.g. system element targeting TRL 5-6) at least demonstrating the feasibility of the integration in the existing core service.

Additionally, the transfer of research results to possible operations should receive active attention during the project to strengthen the readiness for an operational deployment in the future. Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the results (including IPR) by the said entities must be addressed during the project implementation. Software should be open licensed.

Applicants are advised to consult information on the Copernicus programme in general at [https://www.copernicus.eu/en](https://ati.ec.europa.eu/reports/international-reports/report-china-technological-capacities-and-key-policy-measures) and further details on the topic in the Guidance document.

HORIZON-CL4-2023-SPACE-01-32: Copernicus for Emergency Management:

Innovative methods and technologies to derive advanced products and open new opportunities for an operational deployment.

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 2.5 and 3.5 million. |
| *Type of Action* | Research and Innovation Actions |
| *Eligibility conditions* | The conditions are described in General Annex B. The Joint Research Centre (JRC) may participate as member of the consortium selected for funding. |
| *Technology Readiness Level* | Activities are expected to achieve TRL6 by the end of the project – see General Annex B. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  The granting authority can fund a maximum of one project. |
| *Lump-sums* | Yes |
| *Key Policy Trackers* | Climate Action 0%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: Project results are expected to contribute to at least three of the following expected outcomes:

* automated characterisation of building height and building use (e.g. residential, industrial, commercial, public, poor/rich) through integration of different sensor types (e.g. optical, radar, night time lights) and/or open source non-EO data,
* integration of new sensors (incl. 3D data derived from multi sensor platforms) for active global fire detection and fire monitoring (delineation, grading, damage assessment) from geosynchronous and Geostationary sensors, including refined post-processing for active-fire detection confidence and false alarm removals,
* integration of high and very-high spatial resolution data and sensors for continuous multi-scale mapping and assessment of fuel structure and condition at pan-European level, including active (SAR, Lidar) and passive remote (multispectral and hyperspectral) sensing data,
* improvements of the hydrological predictions for the flood (including flash floods) and drought early warning and monitoring component through data assimilation and/or multi-objective parameter calibration and regionalization using satellite based or in-situ data
* improvements of the hydrologic process representation in the continental or global scale hydrologic model of the flood and drought early warning and monitoring component
* methods for addressing limitations of Synthetic Aperture radar (SAR) based flood monitoring in Urban areas or under dense vegetation, smooth or sandy surfaces, snow and/or adverse meteorological conditions. The proposed solution needs to be applicable in an operational near-real-time context and for on-demand mode as well as continuous mapping mode.
* enhanced seamless sub-seasonal to seasonal predictions of severe-to-extreme drought events and associated multi-sectoral impacts,
* optimised integration of different data sources (e.g. reanalysis + observations from rain gauges + remote sensing) and different indexes characterising droughts. Possible use of the new datasets to improve also the floods and forest fire components is encouraged (e.g. merged precipitation datasets for hydrologic model initial conditions or improved fire danger risk calculations);
* integration of UAV along the full value added chain (i.e. data planning, flight, data acquisitions and processing) in the current emergency response operations for improving the thematic accuracy of the damage assessment
* advanced drought event tracking methods;

Scope: The R&I area is:

Innovative methods and technologies for emergency related applications to derive advanced products and open new opportunities for an operational deployment addressing the needs of the Copernicus Emergency Management Service

Different aspects should be considered for the service evolution:

* enhancement of an existing element or component through e.g.: technology improvements such as optimal automation of existing processes encompassing innovative artificial intelligent procedures and High Performance Computing (HPC) or adding new data streams in core services; methodological improvements such as optimised modelling tools
* new elements or components to the existing (core) service;
* new services complementing the core services and providing added functionality as required by users; e.g. in a national or regional context.

Actions aimed at service evolution should be developed in response to specific policy and user requirements while seizing the opportunities provided by the evolution in technology.

Although there is no guarantee that developments will be integrated into the operational CEMS, proposals should duly take into consideration practical aspects related to the integration of results into Copernicus services, including feasibility and cost/benefit analysis as well as timeline for technology maturity of the solutions proposed and their deployment in operational environments. Proposals should aim at reaching technology readiness level TRL6, and should include either a proof-of-concept or prototype demonstrating the feasibility of the integration in the existing core service or the added-value of new elements in new application areas.

Additionally, the transfer of research results to possible operations should receive active attention during the course of the project to strengthen the readiness for an operational deployment in the future. Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the results (including IPR) by the said entities must be addressed during the project implementation.

Proposals should build, where possible and relevant, on free and open-source models, tools and datasets already used or produced by CEMS and the software developed should be open licensed.

The Joint Research Centre (JRC) may participate as member of the consortium selected for funding. The possible participation of the JRC may consist in (1) ensuring access to relevant models, tools and datasets of the operational CEMS, (2) providing a good understanding of existing operational workflows and advice regarding the operational feasibility of new developments and (3) testing of new developments/prototypes in a pre-operational setting.

On data fusion, vast amounts of EO-data are now being available for applications in the disaster domains. Identification of complementary data sets, development and testing of new and innovative ways (if applicable also in the context of social innovation) to efficiently integrate them in emergency applications will be used to generate added-value and new intelligence. Besides satellite data, additional ones include in-situ observations and measurements, meteorological data from ground weather stations and radar, data from aerial platforms, social media or crowd-sourcing, as well as information generated from other sources and other Copernicus services. Whenever appropriate, the project should take advantage from Copernicus and EGNSS synergy. Potential security threats (e.g. cybersecurity) in the data flow and sensitivity of data and service products should be duly taken into account.

Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service within the period 2021-2027. The proposed research and development should be modular and scalable. The activities of the project should also contribute to the objectives set by the Group on Earth Observation and outcomes and relevant results of the project should be promoted also at international level through the Global Earth Observation System of Systems (GEOSS).

Applicants are advised to consult information on the Copernicus programme in general at [https://www.copernicus.eu/en](https://ati.ec.europa.eu/reports/international-reports/report-united-states-america-technological-capacities-and-key-policy) and further details on the topic in the Guidance document.

HORIZON-CL4-2023-SPACE-01-33: Copernicus in-situ component

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 1.5 and 2.5 million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL5-6 by the end of the project – see General Annex B. |
| *Lump-sums* | Yes |
| *Key Policy Trackers* | Climate Action 0%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: Project results are expected to contribute to two or more of the following expected outcomes:

* Optimal use of early observations. Evaluation and assessment of past observing methods and environmental factors, and on error analysis, quality control and bias adjustment of the in situ historical record;
* Better use of Copernicus relevant observations and auxiliary data collected during R&I projects not easily recoverable and reusable for validation purposes in an operational context;
* Enhanced availability and quality of in situ data critical for the production and validation of Copernicus products and data services;
* Appropriate consideration of Copernicus Services’ cross-cutting challenges and R&I priorities.

Scope: The areas of R&I to be explored to help addressed the above expected outcomes include:

1. Facilitation and demonstration of efficient and methodologically sound reuse of in situ data collected during field campaigns and experiments for validation of Copernicus data and information services.
2. Development of innovative observation strategies and concepts to improve the observational capacity in selected data sparse areas. In the marine context, the gathering and qualification of acoustic observations to characterize marine ecosystems (e.g., micronekton) is an identified priority;
3. Synergistic use of complementary types of surface observations, such as pCO2 and pH observations from research vessels, ships of opportunities and Argo to improve the estimation of air/sea fluxes of CO2;
4. Application of machine learning technologies for the quality control of historic and real-time meteorological and hydrological in-situ observations;

This approach should foster the exploitation of exiting in situ data capacities to close observation gaps in combination with new observing infrastructure and innovative processing/modelling techniques. The proposed developments should be modular and scalable, and proposals should provide a proof-of-concept or a prototype that can be easily adapted by at least one of the Copernicus Services and / or an observing network or similar delivering critical in situ data to Copernicus. The project shall demonstrate the applicability of the outcome for at least one of the Copernicus Services.

Depending on the selected area(s), relevant data providers, observing network operators, research infrastructures, and sensor manufactures should be involved in the proposal to the extent possible.

New in situ observation techniques and sensors should be considered and innovative solutions should be proposed for data processing, quality control, and automation including the use of Artificial Intelligence and machine learning.

Additionally, the transfer from research to operations should receive full attention during the course of the project to strengthen the readiness for an operational deployment in the future. Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the results (including IPR) by the said entities must be addressed during the project implementation. Developed software and collected observations should be open licensed.

Applicants are advised to consult information on the Copernicus programme in general at [https://www.copernicus.eu/en](https://ati.ec.europa.eu/reports/international-reports/report-china-technological-capacities-and-key-policy-measures) and further details on the topic in the Guidance document.

HORIZON-CL4-2023-SPACE-01-34: Copernicus for Marine Environment Monitoring

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 4 and 6 million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL5-6 by the end of the project – see General Annex B. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  The granting authority can fund a maximum of one project. |
| *Lump-sums* | Yes |
| *Key Policy Trackers* | Climate Action 40%  Digital: 40%  Biodiversity: 40% |

Expected Outcome:

Project results are expected to contribute to the following expected outcomes:

* Enhanced quality and efficiency of the Copernicus Marine Environment Monitoring Service to respond to (a) policy and/or user requirements (b) technological developments implementing the space regulation (c) complementing the challenges targeted by the Horizon Europe Mission on “Healthy oceans, seas, coastal and inland waters” and can also contribute to the initiative United Nations Decade of Ocean Science for Sustainable Development.
* Development of efficient and reliable new products chains, calling for new paradigms in data fusion, data processing and data visualisation essential for the service to handle more high-volume satellite data sets and product sets. The baseline is to preserve continuity of what has been achieved while keeping the service modern and attractive.
* Development of new algorithms and processing chains preparing the use of the new types of space observation data (being from new Sentinels or other contributing missions) in order to allow development of new products or the improvement of existing products.

Scope:

The coastal zones have tremendous social, economic and biological value but are exposed to a high level of pressure due to climate change and human activities (e.g. regional sea level rise due to ice melting, coastal erosion, coastal floods, pollution, etc.). It is essential to advance Copernicus solutions to answer policy (e.g. WFD, MSFD, MSP, CFP, Flood Directive, Arctic Policy, Green Deal) needs to better manage and protect the coastal zone, to ensure the development of a sustainable blue economy (e.g. tourism, energy extraction, fisheries, offshore operations, industrial port areas, cities growth) , and to build resilience to climate change, human activities being potentially exposed and vulnerable to many hazards of natural or anthropic origins, including storm surges, flooding, acidification, ice melting, and degradation of ecosystems.

The objective is to implement an advanced and seamless monitoring and forecasting of the ocean from global/regional to coastal scales representative of high-resolution and high-dynamics phenomena (physics, biogeochemistry) to better constrain the coastal applications and models developed at national to local level for several applications. As such the project should encourage a co-production between the EU Copernicus Marine Service global/regional service and Member State coastal services using digital innovation and facilities (including using Copernicus DIAS if appropriate). This requires:

* The development of improved pan-EU satellite coastal observation retrievals (e.g. sea level, sea surface temperature, ocean colour, bathymetry, shoreline position, winds, waves, ice changes.), notably derived from Sentinel data, and an improved access and processing of in-situ data in the coastal zone.
* The development of improved inputs of freshwater flows and associated river inputs of particulate and dissolved organic and mineral matter and the development of standardized methods to couple hydrological models (for river run-offs) with Copernicus Marine and coastal ocean models.
* The development of improved coupling techniques between Copernicus Marine modelling systems and downstream coastal modelling systems operated by Member States and Copernicus Participating States including an impact assessment for key coastal applications (e.g. marine hazards, offshore operations, fishery and aquaculture, pollution) and EU policies (e.g. MSFD, WFP, MSP, CFP).
* New technological tools should be considered and innovative solutions should be proposed for better data exploitation, processing and distribution, e.g. move to cloud and HPC computing, distributed computing, Artificial Intelligence and machine learning (e.g. for automatic feature recognition), ensemble modelling, model coupling & nesting.

Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service. The proposed research and development should be modular and scalable. The transfer of research results to possible operations should receive active attention during the project to strengthen the technical readiness for an operational deployment in the future (e.g. system element targeting TRL 5-6). Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the results (including IPR) by the said entities must be addressed during the project implementation. Software should be open licensed.

The activities of the project should also contribute to the objectives set by the Group on Earth Observation and outcomes and relevant results of the project should be promoted also at international level through the Global Earth Observation System of Systems (GEOSS).

The project could contribute to the objectives set by the DestinE initiative and to the Digital Twin Ocean under development following the H2020 Green Deal call and Horizon Europe calls.

Applicants are advised to consult information on the Copernicus programme in general at <https://www.copernicus.eu/en> and further details on the topic in the Guidance document.

HORIZON-CL4-2024-SPACE-01-35: Copernicus for Land and Water

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 3 and 5 million |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL5-6 by the end of the project – see General Annex B. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  The granting authority can fund a maximum of two project. |
| *Lump-sums* | Yes |
| *Key Policy Trackers* | Climate Action 40%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: Project results are expected to contribute to the following expected outcomes:

* Enhanced quality and efficiency of the Copernicus Land Monitoring service to respond respectively to several Green Dealpolicy and/or user requirements and to technological developments.
* Development of efficient and reliable new products chains, calling for new paradigms in data fusion, data processing and data visualisation essential for the Copernicus Land Service to handle more high-volume satellite data sets and product sets. The baseline is to preserve continuity of what has been achieved while keeping the service modern and attractive.
* Development of efficient and reliable integrated products chains, calling with a holistic approach for better land use planning and hydrological monitoring and forecasting, combining and assimilating the current Copernicus service products, and the potential development of new state of the art products complementing the existing ones.
* Development of a common leading-edge approach across services, and in the area of hydrological modelling serving the interests of various applications including agriculture, navigation, energy, flood prevention, and considering also hydrological climate change monitoring, assimilation of hydrological fluxes at the land-sea interface in ocean models, inland water river monitoring and forecasting (short term forecasting and climate monitoring).
* Development of new algorithms and processing chains (e.g. data fusion, combination, assimilation, into monitoring and forecasting models) preparing also for the use of the new types of space observation data (being from new Sentinels or other contributing missions) should also be envisaged allowing the implementation of new products or the improvement of existing products.

Scope: The area of R&I are:

1. the development of new and innovative methods to integrate the current land products into land surface, land use and cover change, and more sophisticated land planning and allocation models for different environment, including through cross services approaches and using all relevant Copernicus service products, and thus extending the potential limited uptake of land product into land planning decisions, offering new dimensions and new interests for Copernicus land products. In addition, the project should demonstrate the added-values of Copernicus land service products when they are integrated and/or assimilated into the models.
2. the development of an integrated, harmonized and coherent product provision system making use of new and innovative methods to improve the portfolio of the current inland and coastal/shore hydrological satellite observation products with more sophisticated and/or new products, in order to improve global scale hydrological monitoring and forecasting. The development should consider cross services approaches and all relevant Copernicus service products. It should extend the uptake (incl. assimilation) of inland water satellite observation product into hydrological models, consider a consistent approach to hydrological modelling for different purposes (e.g. continental water monitoring under climate change, improved flood and drought forecasting, support to water applications in sectors such as agriculture and energy, forcing coastal models) and offering new dimensions and new interests for Copernicus land, inland and coastal water products. In addition, the project should demonstrate the added-value of Copernicus water satellite observation products when they are integrated and/or assimilated into models based on scientific quality validation approaches.

Proposals should address only one area. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

The projects should take into account the existing service and clearly define to what extent the service will be improved with new elements or products, including the use of enhanced models, algorithms, tools and techniques to generate new product(s).

Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service. The proposed research and development should be modular and scalable. The project should provide a proof-of-concept (e.g. system element targeting TRL5-6) at least demonstrating the feasibility of the integration in the existing core service. The activities of the project should also contribute to the objectives set by the Group on Earth Observation and outcomes and relevant results of the project should be promoted also at international level through the Global Earth Observation System of Systems (GEOSS).

Additionally, the transfer of research results to possible operations should receive active attention during the project to strengthen the readiness for an operational deployment in the future. Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the results (including IPR) by the said entities must be addressed during the project implementation. Software should be open licensed.

Applicants are advised to consult information on the Copernicus programme in general at <https://www.copernicus.eu/en> and further details on the topic in the Guidance document.

HORIZON-CL4-2024-SPACE-01-36: Copernicus for Security

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 5 and 7 million. |
| *Type of Action* | Research and Innovation Actions |
| *Eligibility conditions* | The conditions are described in General Annex B. |
| *Technology Readiness Level* | Activities are expected to achieve TRL5-6 by the end of the project – see General Annex B. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  The granting authority can fund a maximum of one project. |
| *Lump-sums* | Yes |
| *Article 22(5)* | In accordance with paragraph 11 of Annex IV of the Regulation (EU) 2021/695 establishing Horizon Europe, this action is implemented with regard to eligibility of legal entities in accordance with the Union Space Programme. In particular, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, in order to guarantee the protection of the strategic interests of the Union and its Member States, legal entities established in any Member State will be eligible to participate where these entities comply with the conditions established in Article 24 of the Regulation (EU) 2021/696[[135]](#footnote-136). |
| *Key Policy Trackers* | Climate Action 40%  Digital: 40%  Biodiversity: 0% |

Expected Outcome: Project results are expected to contribute to the following objectives:

* Enhanced fitness of the current services to better respond to evolving policy and user requirements.
* Enlargement of current service scope through the inclusion of new, complementary elements and extended communities of users.
* Significant technological enhancement in detection capabilities, timely access to data or delivery of information, narrowing the gap between capabilities and the more stringent security observation requirements.
* Significant improvement in integration of non-space data along end-user intelligence supply chains, bringing added value at operational level also at regional at local levels, or in support to field campaigns.
* Development of processing chain(s) to handle an increasing volume of satellite data, keeping abreast with technology developments and include new paradigms in data fusion, processing, automation, as well as added-value information access and visualisation.

Scope:

Copernicus Security Services provide, today, a valuable contribution to civil security, law enforcement operations and crisis management in Europe as well as in support to its external actions. Technology and space capacities have been evolving significantly, creating opportunities for an increased outreach across a broader spectrum of related applications.

Member states are also calling to reinforce Copernicus to better contribute to resilience and security in support to civil security and to better react and recover from major upcoming crisis of various forms, such as population displacement due conflicts, impact of climate change or extreme weather phenomena at global or regional levels. The Commission is as well anticipating on these needs and considering developing an enlarged portfolio of resilient services addressing new threats, for governmental use and complementary to national end existing EU capacities.

R&D activities should therefore support an increase in service performance, outreach and scope, aiming particularly at fostering:

* Innovative methods and technologies to explore new and enlarged data sets and the development of applications addressing requirements not currently tackled by the current services.
* Actions in support to the evolution and scope of the security services, namely increasing user reach, responding to specific regional needs and increasing service added value in user operational scenarios .

More detailed information and guidelines will be provided in the ***Strategic Research Agenda for Copernicus Security Services***[***[1]***](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en%2DUS&rs=en%2DIE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-HE-DEFIS%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F55339a65b48149188c32ca6b145add0e&wdenableroaming=1&mscc=1&hid=93012AA0-B09E-3000-D1A5-E2644BD53AAC&wdorigin=AuthPrompt&jsapi=1&jsapiver=v1&newsession=1&corrid=c582f3d2-d48e-4365-bba3-1735e58f7664&usid=c582f3d2-d48e-4365-bba3-1735e58f7664&sftc=1&mtf=1&sfp=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush&rct=Medium&ctp=LeastProtected#_ftn1) (SRA-CSS V1.0, to be released end 2022).

Actions aimed at service evolution will have be developed in response to specific policy and user requirements at European, Regional or National level, possibly making also use of data generated by any of the other Copernicus services, whenever relevant. .

Proposals shall be explicit w.r.t. their relevance on (1) the complementary of service provision, namely in terms of added-value, users, service portfolio, policies or data sets or (2) the added-value of the integration of results into Copernicus core services. As such, they should include feasibility and cost/benefit analysis, as well as a timeline for deployment in operational environments and a proof-of-concept or prototype demonstrating the feasibility of the integration in the existing core service or the added-value of elements targeting new application areas.

Attention should be paid to elements enabling R&D spin-out to operational environments, such as the need to re-use and exploit the results (including IPR) to the entities implementing the EU Copernicus programme. Resulting products, software in particular, should be open licensed allowing it to be installed, copied and adapted to the operational environment it will be intended for.

Proposers are advised to exploit all possible synergies with other security specific actions funded under the work programme of Cluster 3 “Civil security for society”.

Proposals are expected to provide tangible impact (new or improved products or service elements) for the period 2025-2027. As such, preference will be given to proposals with service elements e.g. system element targeting at least TRL 5-6. demonstrating the feasibility of the integration in the existing core service or the development of new, complementary elements.

Applicants are advised to consult information on the Copernicus programme in general at [https://www.copernicus.eu/en](https://ati.ec.europa.eu/reports/international-reports/report-united-states-america-technological-capacities-and-key-policy) and further details on the topic in the Guidance document.

[[1]](https://euc-word-edit.officeapps.live.com/we/wordeditorframe.aspx?ui=en%2DUS&rs=en%2DIE&wopisrc=https%3A%2F%2Feceuropaeu.sharepoint.com%2Fteams%2FGRP-HE-DEFIS%2F_vti_bin%2Fwopi.ashx%2Ffiles%2F55339a65b48149188c32ca6b145add0e&wdenableroaming=1&mscc=1&hid=93012AA0-B09E-3000-D1A5-E2644BD53AAC&wdorigin=AuthPrompt&jsapi=1&jsapiver=v1&newsession=1&corrid=c582f3d2-d48e-4365-bba3-1735e58f7664&usid=c582f3d2-d48e-4365-bba3-1735e58f7664&sftc=1&mtf=1&sfp=1&instantedit=1&wopicomplete=1&wdredirectionreason=Unified_SingleFlush&rct=Medium&ctp=LeastProtected#_ftnref1) A Copernicus initiative (DEFIS/JRC/MSs) kicking -off 2nd quarter of 2022 to bridge Copernicus Security Services with R&D at EU and National levels

## 5.4 EGNSS and Copernicus Downstream

HORIZON-EUSPA-2023-SPACE-01-41: EGNSS - Transition toward a green, smart and more secure post-pandemic society (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 6 and 10 million. |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL 7-9 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | YES |
| *Key Policy Trackers* | Climate Action 40%  Digital 40%  Biodiversity 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Stimulate the development, validation and use of commercial downstream solutions based on synergies between different space programme components Galileo, including its differentiators (OSNMA, HAS, RLS, CAS etc.), EGNOS, Copernicus (if relevant), combined with connectivity/5G and SATCOM and cutting-edge digital technology to enable more efficient and resilient solutions for tomorrow’s society;
* Foster the development and validation of integrated synergistic space technologies that improve the quality of life in Europe, toward environmentally-friendly and energetically-efficient communities, in support of the EU mission on climate-neutral and smart cities[[136]](#footnote-137);Exploit the increasing digitalisation paradigm and the adaptation of business processes in the post-pandemic environment to create new space-based commercial opportunities improving the prospects of businesses and the life of citizens.

Scope: The COVID-19 crisis highlighted importance of digital technologies and infrastructures as vital societal assets. EU space technologies have demonstrated to be instrumental to a large number of activities. The scope of this action is the development of space-based synergistic technologies for a green, smart and more secure solutions addressing a variety of social and economic challenges which emerged during the COVID-19 pandemic crisis.

By leveraging EGNSS services including their differentiators (OSNMA, HAS, RLS, CAS etc.), proposals should develop applications and technologies that focus on commercial exploitation in one of the following priority areas:

* Development of downstream commercial applications, which foster the creation of cities built around its citizens, developed on efficient mobility solutions, environmentally-friendly and energetically-efficient. It may also cover the development of automated solutions for personal assistance, healthcare, support to the elderly, city dashboards, or applied robotics and/or applications that boost the green, safe and digital transition of the construction industry;
* Development of downstream solutions based on Galileo, EGNOS and Copernicus (if relevant), combined with connectivity/5G and SATCOM and cutting-edge digital technology to enable more efficient and resilient solutions for tomorrow’s society. The solutions shall address the challenge of higher reliance on the capacity provided by the existing infrastructures (Energy, Telecom, Finance, Insurance etc.), the increased use of remote resources and remote work modality and the awareness of the associated cyber-threats. It may also cover applications for claims assessment (insurance), or time-stamping of transactions (finance), as well as commodities trading and risk assessment. With a view to the energy, communication and banking applications, proposals could develop solutions for the certification of GNSS based timing equipment. With regard to the energy sector, particular emphasis could be put on ideas enabling an increased share of electricity from renewable sources (e.g. monitoring and forecasting of electricity generation from wind and solar power).

Proposals could, if applicable, integrate other data sources or services, in particular, where relevant, in combination with Copernicus.

Underpinning technologies may include metaverse and/or Digital Twins (DT) for cities, industries or Critical Infrastructures, tele-presence tools, wearables, AR/VR, secure interconnected IoT networks, sensor integration, technologies allowing seamless indoor-outdoor navigation, solutions for autonomous mobility, integrated secure fleet and objects (.e.g. parcels, containers etc.) management systems, new cyber-security paradigms based on Quantum Key Distribution (QKD) etc.

Applications may also consider, if applicable, the integration of future GOVSATCOM services into their commercial solutions and the use of data models for transforming the Galileo signal to a proper geodetic reference frame, allowing the exploitation of its differentiators e.g. the Galileo High Accuracy Service..

The Proposals shall:

* Address innovative applications and technologies that focus on one or more of the priority areas defined above;
* Present a solid business plan, including the quantification of the market potential, value proposition and exploitation strategy. The elements of innovation and the challenge to overcome as well as address barriers/issues which might hinder their commercial exploitation;
* Preliminary define and be designed to satisfy user needs, possibly seeking the direct participation of users, customers and/or public authorities concerned in the proposed solution (e.g. infrastructure managers, actors in the finance and insurance domain, municipalities etc.).

HORIZON-EUSPA-2024-SPACE-01-42: EGNSS - Closing the gaps in mature, regulated and long lead markets (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR x and x million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 6 and 10 million. |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL 7-9 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | YES | |
| *Key Policy Trackers* | Climate Action 40%  Digital 40%  Biodiversity 0% | |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Broaden the reach of EGNSS, by supporting its adoption in mature, regulated long lead markets, including rail,maritime inland waterways, fisheries and aquaculture, road and automotive, aviation;
* Development of industry-accepted certification and standardization schemes that exploit the use of EGNSS and its differentiators for operational services.

Scope: Standardization and certification for the use of GNSS in regulated markets is a costly and time-consuming process. The topic aims to gaps in mature, regulated and long lead markets and deliver concrete pathways to standardization and certification towards broader EGNSS adoption. Proposals may be submitted in any of the following areas:

* Closing the related standardization and certification gaps for **rail safety critical applications** that support the rail network efficiency and cost reduction, converging towards a pan-European EGNSS-based solution adoption, within the European Rail Traffic Management System (ERTMS) evolution or adoption within railway lines that do not require a full interoperability with ERTMS. Proposals may contribute to pilot projects and tests (e.g. large-scale demonstrators within Europe´s Rail JU projects) supporting the approval of the EGNSS-based solutions by relevant safety authorities. Relevant activities to be addressed include the amendment of the ERTMS technical specifications for interoperability to support the use of EGNSS for train localization and, possible synergies with Copernicus and/or GOVSATCOM, including also the integration with other sensors for the infrastructure monitoring;
* EGNSS-supported safe and efficient operations in **coastal areas, maritime** (including for energy production e.g. off-shore wind farms)**, inland waterways, fisheries and aquaculture** , addressing potential standardization and certification bottlenecks and assisting a diverse pool of stakeholders, ranging from vessel operators and recreational boaters. Proposals may explore the regulatory and compliance certification conditions for the use of EGNSS and its differentiators (e.g. OSNMA, HAS, RLS, EWS etc.) to support port operations, efficient and secure navigation in inland waterways or areas previously considered too dangerous or inaccessible such as new maritime routes or shallow inland waters. Exploration of relevant synergies with Copernicus and/or GOVSATCOM could be included, addressing the certification and regulatory aspects that their use might bring;
* Addressing potential standardization and certification bottlenecks for the use of EGNSS for **road and automotive** market safety-related applications in scenarios of potential harm to humans or damage to a system/environment (e.g. connected and autonomous cars, emergency assistance), liability applications (e.g. insurance telematics ) and fleet management systems, in particular the management of priority goods by electronic freight transport information (eFTI) . EGNSS-based systems that contribute to reducing congestion and associated emissions, improving the safety and efficiency of road transportation. Examples of areas requiring further consolidation include standardization and certification aspects for the iimplementation of the Galileo Emergency Warning System (EWS) in automotive applications leveraging the interoperability via digital maps, the Galileo HAS in the deployment of 5G high accuracy networks for automotive applications, reduction of congestion charging in urban areas, maintenance of roads and enhanced driving comfort. Exploration of relevant synergies with Copernicus and/or GOVSATCOM could be included, addressing the certification and regulatory aspects that their use might bring;
* Applications for the **aviation** market that require further consolidation include aircraft operations and planning for more efficient and green operations supported by EGNSS and its differentiators, EGNSS timing for 4D trajectory operations, EGNSS timing for System Wide Information Management (SWIM), integration of Dual Frequency Multi-constellation (DFMC) SBAS in avionics/aircraft and integration of Copernicus data into current aviation systems, on-board or on-the-ground supporting airport operations and validation of operations via DFMC and the Galileo ARAIM. Proposals may also include applications for drones urban air mobility including urban air deliveries trough EGNSS data and services for the navigation operations, supported by EO data with provision of meteorological data, terrain and obstacle information. Exploration of relevant synergies with Copernicus and/or GOVSATCOM could be included, addressing the certification and regulatory aspects that their use might bring.

The Proposals shall:

* present a solid preliminary overview of the standardization and certification gaps and propose clear steps to address and close them;
* seek the participation of standardization and certification entities or authorities concerned with the regulatory requirements of the sectors that they address.

Applications may also consider the interconnection and integration of future GOVSATCOM and/or Copernicus services into the regulatory environment, if applicable.

Applicants are advised to exploit, if applicable, possible synergies with other specific actions funded under the work programmes of Cluster 5 “Climate, Energy and Mobility” and of Cluster 6 “Food, Bioeconomy, Natural Resources, Agriculture and Environment”.

HORIZON-EUSPA-2023-SPACE-01-43: Copernicus-based applications for businesses and policy-making

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow the expected outcome to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 6 and 8 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL T1 and achieve TRL T2 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | YES |
| *Key Policy Trackers* | Climate Action 40%  Digital 40%  Biodiversity 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Copernicus is providing Europe with large volumes of Earth Observation data as well as six Services: Atmosphere, Marine, Land, Security, Emergency and Climate Change. This opens up the possibility to develop a wide range of applications for businesses and policy-making, including ones that are transversal across several or all of the six services.
* Projects will enhance existing applications or develop new applications and products relying on Copernicus data and services, making impact on users, businesses and/or answering needs from public authorities, e.g. support policy making and implementation such as for the Green Deal or Destination Earth or the Horizon Europe missions.

Projects will contribute to increasing the integration and uptake of Copernicus data, services and applications in the European economy, in particular the European data economy.Scope:

Applications will build on Copernicus data and the latest evolutions of the Copernicus services and may combine these with other sources of data or services, in particular, where relevant, iother space capacities like data collection, satcom, navigation, in particular the European satellite positioning/navigation/timing services and EGNSS technologies.

Targeted areas should be:

1) Copernicus applications downstream of the Copernicus Emergency service for better preparedness of local authorities, citizen, local industries and services to more frequent extreme events, geohazards, prediction insurances, preparing for a better resilience to climate change, for better local emergency management and short-term recovery.

2) Copernicus applications downstream of the Copernicus Security service or exploiting the combination of Sentinels with national contribution missions or new space services to develop national to local services supporting resilience to upcoming major pan-European crisis like pandemics and the social and economic consequences of it.

3) Copernicus applications downstream of the Marine service, with special focus on biodiversity conservation, maritime spatial planning, local and demersal fisheries, coastal to shore services, new sources of pollution from land, blue carbon farming as well as applications addressing the objectives of the EU mission on ‘Restore our oceans and waters’ lighthouses. The applications shall build on existing infrastructure (e.g. Copernicus DIAS) and services (e.g. Copernicus Marine Service) to create solutions which can be practically utilised by policy- and/or decision-makers, industry actors and/or controlling agents to support processes that reinforce sustainable use of resources, alleviating pressure on marine ecosystems.

4) Copernicus applications downstream of the Land service for better land use and/or natural resources planning (e.g. supply chain management for the raw materials sector) and for citizen awareness and reporting of environmental and biodiversity protection issues, using the new and improved land service products such as the ground motion service products, for industrial ecosystem development, land cover/use layers and inland water indicators.

6) Applications downstream of the Climate Change Service for including e.g. improved forecast and preparedness aimed to counteract extreme climate events and/or integrating Sentinel Data and other climate datasets in decision-support systems in the area of Agriculture, Energy (e.g. planning and assessment for renewable energy resources), Hydrology, Health,Disaster Risk Reduction, insurances (e.g. climate-risks related insurances) and/or the finance sector (e.g. green loans)

7) Applications downstream of the Atmosphere Monitoring Service that tailor, refine and combine the products for serving users particularly in the areas of air quality, health, biodiversity, wildfires monitoring and greenhouse gases.

Proposal should address only one area. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

In order to give confidence that expected outcomes will be delivered by the projects, proposals are requested to:

* Clearly identify the targeted businesses and/or needs from public authorities;
* Quantify the outcome of the projects on these, including on the targeted policies where relevant;
* Describe how they plan to use the existing Copernicus data and Services, Copernicus DIAS platforms and give feedback to these e.g. with recommendations yielding improved quality and integrated data management;
* Where relevant, demonstrate how they build on previously developed and existing applications
* Present a clear exploitation plan describing the pathway for the use of the application(s) after the project completion as well as a business plan and/or a strategy of adoption by public authorities which includes financing perspectives, the challenge to overcome as well as address barriers/issues which might hinder their exploitation;
* Demonstrate how the application answers the needs of users, public authorities and private sector and associate these in the course of the projects, including for public authorities;
* Rely on state-of-the-art digital technologies (e.g. AI, Big Data, HPC) which have the capacity to exploit and process large volumes of data and make use of existing European data infrastructures (e.g. DIAS);
* If applicable, integrate other data sources, services and models, in particular, where relevant, in combination with EGNSS services and its differentiators;
* Address issues such as data quality, uncertainty and errors as well as standardisation aspects where relevant.

HORIZON-EUSPA-2023-SPACE-01-44 The Galileo PRS service for governmental authorised use cases (IA)

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR x and x million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 6 and 10 million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-4 and achieve TRL 5-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security in the area of research covered by this topic, participation is limited to legal entities established in those Member States that have put in place a Competent PRS authority (CPA). The proposed activities shall be carried out in full compliance with the applicable PRS regulatory framework. |
| *Lump-sums* | YES | |
| *Key Policy Trackers* | Climate Action 0%  Digital 40%  Biodiversity 0% | |

Expected Outcome: Projects are expected to contribute to the following outcomes:

1. Develop the use cases for authorised civilian users based on the added value of PRS service;
2. Develop the PRS applications targeting civilian users by leveraging PRS technology;
3. Build on top of previous exploratory activities and lessons learnt on the development of PRS items by stimulating the corresponding downstream PRS uptake;
4. Foster an EU-level cooperation of industrial entities for the development of authorised PRS applications;

Scope: Proposals should identify, design and create applications leveraging the items for the first generation of Galileo. Applications should address the governmentally authorised user communities and scenarios for which the technical, operational and security related features requirements of PRS Service constitute barriers to entry. The applications should target well-identified operational environments in which the PRS Service features (e.g. continuity of service and access control) may play a differentiator role. Representatives of potential user communities should be involved as far as possible in the development of the prototypical applications.

Multidisciplinary activities could address one of the following:

* Critical infrastructure management and security;
* Law enforcement;

Proposals submitted under this topic shall include a business case, exploitation strategy and the risk and threat analysis (highlight the risks related to the potential use of such technologies and proposed mitigations solutions on the user system level).

The submitted proposal, supported by the risk and threat analyses shall address specify of the PRS service considering the technological, policy and exploitation in the environment of use.

Development should build on existing standards or contribute to standardisation. EU- cross boarders’ cooperation is requested.

Proposals submitted should ensure gathering at least 3 potential EU user communities (at least from 3 different PRS Participants).

Each of proposals will be evaluated according to SMART approach:

* **S**pecific = The activity must bring a specific added value;
* **M**easurable =
  + The activity must be beneficial/shared for the whole targeted PRS User segment;
  + The activity brings a specific output with measurable results/outcome;
* **A**ttainable/**R**ealistic = The activity must be coherent with the PRS priorities established at Programme level, coherent with the regulatory framework, and realistic in view of the operational, schedule, market and political constraints;
* **T**imely = The activity must be completed/implementable and exploitable by PRS FOC;

HORIZON-EUSPA-2023-SPACE-01-45 Joint Test Activities for Galileo PRS service (IA)

Restrictions of Article 22.5 will apply

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| **Specific conditions** | | | | |
| *Expected EU contribution per project* | | | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | | | The total indicative budget for the topic is between EUR 6 and 10 million. | |
| *Type of Action* | | | Innovation Action | |
| *Technology Readiness Level* | | | Activities are expected to start at TRL 3-5 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | | | The rules are described in General Annex G.  Intended 100% funding. | |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security in the area of research covered by this topic, participation is limited to legal entities established in those Member States that have put in place a Competent PRS authority (CPA). The proposed activities shall be carried out in full compliance with the applicable PRS regulatory framework. | |
| *Lump-sums* | | | YES | |
| *Key Policy Trackers* | | | Climate Action 0%  Digital 40%  Biodiversity 0% | |

* Support the Programme activities related to the validation of the PRS Service,, Support the PRS Participants defined activities related to testing, validation and introduction of the PRS Service;
* Build on top of previous Joint Test Activities and lesson learnt thereof;
* Foster cooperation among EU PRS Participants;

Scope: Proposals shall be coordinated by the Competent PRS Authorities and should address actions related to the:

* validation and verification PRS Service (support to the Galileo Programme);
* testing of PRS Service and PRS items (PRS Participants actions);
* preparation of the awareness activities and uptake to the authorised users;

Proposals submitted should ensure gathering at least 3 PRS Participants (supported by the respective Competent PRS Authority that are a party to the grant).

The proposed activities shall be carried out in full compliance with applicable regulatory framework (e.g. Decision 1104/2011, PRS regulatory framework).

The Agency intends to award the Framework partnership agreement to up to 3 consortia. The detailed tasks will be specified under the specific grants.

Each of proposals will be evaluated according to SMART approach:

* **S**pecific = The activity must bring a specific added value;
* **M**easurable =
  + The activity must be beneficial/shared for the PRS User segment;
  + The activity brings a specific output with measurable results/outcome;
* **A**ttainable/**R**ealistic = The activity must be coherent with the PRS priorities established at Programme level, coherent with the regulatory framework, and realistic in view of the operational, schedule, market and political constraints;
* **T**imely = The activity must be completed/implementable and exploitable by the relevant PRS milestone to be target per each specific grant;

HORIZON-EUSPA-2024-01-46 Designing space-based downstream applications with international partners (RIA)

|  |  |
| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between xx million and xx million Euro would allow the outcomes to be addressed appropriately. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 5 and 7 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 1-2 and achieve TRL 3-4 by the end of the project – see General Annex B . |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Eligibility conditions* | The conditions are described in General Annex B. The following exceptions apply for proposals involving Copernicus: due to the scope of this topic, legal entities established in countries that have signed an administrative cooperation arrangement on Copernicus data access and Earth observation data exchange are exceptionally eligible for Union funding. Currently, these countries are: the United States, Australia, Ukraine, Chile, Colombia, Serbia, African Union, India and Brazil. Discussions towards similar cooperation have been started with other countries and regions (including United Nations Agencies and Asia-Pacific countries). |
| *Lump-sums* | YES | |
| *Key Policy Trackers* | Climate Action 0%  Digital 0%  Biodiversity 0% | |

Expected Outcome: Projects with international partners are expected to contribute to the following outcomes:

1. The use of EGNSS and sharing of expertise with public and/or private entities to introduce EU- –space-based applications/solutions, leveraging their innovative, unique features, in particular Galileo differentiators (authentication, high accuracy) and European know-how.

2. The use of Copernicus data, to develop jointly algorithms, services and/or products, which serve local user needs and/or enhance the Copernicus global product quality.

3. The combined use of EGNSS and Copernicus to develop innovative downstream applications combining positioning navigation and timing with earth observation services.

Projects will also contribute to the following objectives:

* Lead to new or improved products, processes or services – using EU space technologies (Copernicus, EGNSS as enabler) that are capable of generating a marketable solution for the local market.
* Maximise and spread the benefits of space-based applications and solutions enabled by EGNSS and/or by Copernicus, to leverage downstream space excellence, in particular of SMEs and universities, to facilitate investments and to foster market uptake.
* Create partnerships with non-EU entities towards commercialization, to trigger public and/or private investment from Europe and beyond to take advantage of market opportunities in Europe or local markets.
* Build capacity and awareness-raising around EGNSS- and Copernicus-based applications and solutions, particularly in the regulated domains.

Scope: Proposals should target one or more of the three expected outcomes. Proposal can also include the use of other space-based or non-spaced based assets and services, with a preference given to those based in the EU and in the international cooperation partners countries applying to this topic.

The actions should focus on technical developments of EU- –space-based applications/solutions, dissemination, awareness-raising, as well as provide opportunities for the creation of business-oriented partnerships between European industry and international partners. By doing so, the action should be achieving a critical mass of space based-application success stories, demonstrating the advantages and differentiators of EU space-based solutions and services and making it an attractive option for public authorities, private industries and private investors in and outside of Europe.

Cooperation with international partners, either public or private, is key to:

* Promoting the uptake of satellite navigation, position and timing, to enable non-EU countries to benefit from the advanced and unique features offered by EGNOS and Galileo, particularly in transport and regulated domains.
* Promoting the uptake of Copernicus globally, exploiting possibilities for integrating in-situ space data and information technologies.
* Building the Copernicus full, free and open data policy, considering that the European Commission seeks to facilitate access to Copernicus data and information for interested international partners. Administrative cooperation arrangements on Copernicus data access and Earth observation data exchange have already been signed with several countries; the United States, Australia, Ukraine, Chile, Colombia, Serbia, African Union, India and Brazil. Discussions towards similar cooperation have been started with other countries and regions (including United Nations Agencies and Asia-Pacific countries). Tasks may include joint calibration and validation activities or integration of local in-situ systems to enhance the quality of data and service products.

It is important to exploit the value-added of integration of EO data (both satellite, airborne and ground-based) with positioning ones and ICT (e.g. cloud computing) from international partner countries, through the development of applications and support to , their insertion into the market. Technology promotion activities can include incentive schemes in the form of financial support to third parties, that will promote the uptake of space downstream applications across Europe and globally.

For proposals under this topic:

* Proposals dealing with EGNSS are encouraged to involve the relevant players on the European side whenever relevant (e.g. European Union Aviation Safety Agency (EASA), European Satellite Service Providers (ESSP) or Member States’ Air Navigation Service Providers for EGNOS Safety of Life service to aviation, European Maritime Safety Agency (EMSA), ERA for other transports). Participation of industry, in particular SMEs, is encouraged;
* When dealing with Copernicus-based applications, participation of at least one partner from a country that has signed a Copernicus Cooperation Arrangement is required. Proposals are encouraged to use the Copernicus Data and Information Access Services (DIAS, or other existing data access solutions, instead of setting up their own download and processing infrastructure. They are also encouraged to integrate third-party data (including in-situ data) and envisage data assimilation into models and products made available on the Copernicus platform of the Copernicus services. Participation of partners involved in international GEO initiatives is encouraged. Participation of industry, in particular SMEs, is also encouraged;
* Involvement of public authorities is encouraged, whenever relevant;
* Involvement of post-graduate scientists, engineers and researchers is encouraged, whenever relevant.

## 5.5 GOVSATCOM , Quantum, Space Weather

HORIZON-EUSPA-2023-SPACE-01-61: EU GOVSATCOM for a safer and more secure EU (PCP)

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 8 and 12 million. |
| *Type of Action* | Pre-Commercial Procurement (TBC) |
| *Technology Readiness Level* | Activities are expected to start at TRL 6 and achieve TRL 7-9 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, or security, namely safe, secure and sustainable access to, operations in and return from outer space, **participation is limited to legal entities established in Member States only**. Proposals including entities established in countries outside the scope specified in the call/topic/action will be ineligible. |
| *Lump-sums* | No |
| *Key policy trackers* | Climate Action 0%  Digital: 100%  Biodiversity: 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Identification, assessment and development of one or more suitable use case in the area of surveillance, crisis management and key infrastructure;
* After identification of technical specifications agreed with the contracting authority, support the development and/or improvement of GOVSATCOM demonstration terminals enabling end-to-end validation of the first services provided by the GOVSATCOM HUB;
* Stimulate the definition of the validation strategy of the early developed GOVSATCOM services;
* Foster the identification/definition of GOVSATCOM tools required for the development of the GOVSATCOM terminals for future GOVSATCOM HUB services.
* Develop the application, necessary to enable end-to-end demonstration of the selected use case(s) using services provided by the EU GOVSATCOM Hub and operational terminals;
* Perform extensive in-field activities aimed at verifying the suitability of the solution, involving the relevant user communities to grow awareness and stimulate adoption of the EU GOVSATCOM services by the concerned users[[137]](#footnote-138);
* Elaborate the definition of the validation strategy and gather users’ feedback to feed the development and the evolution of the EU GOVSATCOM services;

The GOVSATCOM use cases and associated operational terminals could leverage, when possible, on previous development. The operational terminal shall verify its compatibility with the EU GOVSATCOM services, with the operational constraints and needs, and thoroughly assess the performance in the field while promoting the integration of secure communications in already existing systems and use of other space components, for example EGNSS and Copernicus.

The projects shall aim at identifying and address technological challenges related to the provision of GOVSATCOM services and increasing awareness on the benefits brought by the use of secure services provided by GOVSATCOM and will engage the users, public authorities and policy makers to the maximum extent.

Scope: Proposals should select at least one GOVSATCOM use case and support the adaptation of one or more existing SATCOM terminals in order to carry out the demonstration. The target use cases may be selected among (non-exhaustive list):

* Surveillance, including both land and sea scenarios;
* Crisis management, such as telemedicine, humanitarian aid, civil protection, law enforcement, EU external action, maritime emergency, search and rescue,;
* Key infrastructure, such as transport (Air, Rail, Road, Maritime) management, space infrastructure, institutional communication, critical infrastructure (energy grid, CBRN, financial infrastructure, telecommunication/ICT).

The beneficiary should build a consortium and improve one or more operational terminals to demonstrate the access of the respective users to an early EU GOVSATCOM service. The beneficiary should take into consideration the necessary transfer of know-how and IPR between the consortia developing the operational use case and the reference terminals as a basis. The beneficiary should demonstrate the use of the developed operational terminals and make available to the Commission through the Granting Authority the findings of the development and the demonstration.

In frame of the demonstration activities it is expected to involve the MSs industrial stakeholders and the equipment should therefore support the demonstration activities of the early developed services.

These activities will be implemented by EUSPA under a Contribution Agreement between the Commission and EUSPA. The procurement actions under this section will affect the essential security interests of the Union, and will therefore require restricted participation that will be established in the tender specifications. In such case, participation should in principle be open only to entities established in the EU Member States. Participation of entities established in Horizon Europe associated countries or in third countries will be subject to the establishment of an ad-hoc international agreement.

HORIZON-CL4-2023-SPACE-01-62: Quantum Communication Technologies for space systems

Restrictions of Article 22.5 will apply

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR xx would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 4 and 6 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL5-6 by the end of the project – see General Annex B |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | Yes |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States + Norway and Iceland under Protocol 31 of the EEA Agreement (and other associated countries, provided certain conditions are met).  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| *Policy Trackers* | Climate Action 0%  Digital: 40%  Biodiversity: 0% |

Expected outcome:

* Support the EU space policy and the EU initiative to establish the Union Secure Connectivity Programme and foster the development of ultra-secure EU services based on or using space systems
* Ensure the EU sovereignty and non-dependence for the development of capacities leading to the availability of ultra-secure services based on QKD
* Enhance the TRL of the critical components necessary to build QKD space systems and foster the development of the associated QKD standards.

These outcomes will contribute to securing the autonomy of supply for critical technologies and equipment for QKD space systems in the EU, and foster the EU's space sector competitiveness by developing the associated ecosystem, in line with the Expected Impact of the destination. Security aspects shall be considered in all targeted developments and where necessary, information will be classified.

Proposals must address all the above-mentioned, expected outcomes.

Scope: The scope of this topic is the development of the critical components and technologies necessary to build a space quantum key distribution system. Based on the principle that any component used to generate, store, transmit, receive, decode, or use quantum information is considered a critical component, the scope of this topic covers all the critical hardware and software components necessary for the quantum key distribution function to be implemented via a satellite payload, as well as the corresponding optical ground station. Proposals will consider both Prepare and Measure (P&M) and Entangled protocols. In addition, proposals should address the issue of standardisation for QKD space systems. Proposals should propose and implement the development of international space QKD standards in existing standardisation bodies working groups (e.g. ETSI) or propose and implement the creation of new standardisation activities through the creation of additional working groups. Given the sensitivity of the developments produced within the projects, all the hardware & software developments and associated technical documents will be classified RUE.

HORIZON-CL4-2023-SPACE-01-63: Quantum Space Gravimetry Phase-A Study

Restrictions of Article 22.5 will apply

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR xx million would allow these outcomes to be addressed appropriately. Two proposals will be selected. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 2 and 4 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL 3 by the end of the project – see General Annex B |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | Yes |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States + Norway and Iceland under Protocol 31 of the EEA Agreement (and other associated countries, provided certain conditions are met).  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| *Policy Trackers* | Climate Action 40%  Digital: 0%  Biodiversity: 0% |

Expected outcome:

* Support the EU space policy and the green deal by assessing the feasibility of a quantum space gravimetry pathfinder mission
* Propose a mission, system and operation concept for the Quantum Space Gravimetry pathfinder mission
* Establish the list of critical components for a Quantum Space Gravimetry mission

These outcomes will contribute to securing the EU autonomy of supply for critical technologies and equipment, and foster the EU's space sector competitiveness, in line with the Expected Impact of the destination.

Two phase-A study proposals will be selected under this call, and their outcomes will contribute to the selection of a Quantum Space Gravimetry pathfinder mission. Activities under this call will also foster the EU leadership in the field of quantum sensing technologies.

Scope: The final objective of this call is the selection of a Quantum Space Gravimetry pathfinder mission. To achieve this objective, two phase-A proposals for a feasibility study, as specified in ECSS‐M‐ST‐10C, will be selected. The scope of this topic covers in particular the system and operations concept of the pathfinder mission leading to a technical solution deployable before the end of the decade. A particular attention will be drawn on the analysis of the critical technologies and components necessary to deploy this mission, and proposals shall address the technological maturation necessary to meet this objective, based on EU solutions. The proposals will detail the reviews organised under the study. These reviews, organised by the consortium, will be open to COM and ESA experts. Each study will conclude with a Preliminary Requirement Review.

It is expected to fund 2 projects

Annex: QSG Pathfinder mission statement

HORIZON-SPACE-2024-01-64: Quantum Space Gravimetry Phase-B study & Technology Maturation

Restrictions of Article 22.5 will apply

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| *Expected EU contribution per project* | The Commission estimates that a EU contribution of EUR xx million would allow these outcomes to be addressed appropriately. One proposal will be selected. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 12 and 16 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to achieve TRL6/7 by the end of the project – see General Annex B |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

|  |  |
| --- | --- |
| *Lump-sums* | Yes |
| *Article 22(5)* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States + Norway and Iceland under Protocol 31 of the EEA Agreement (and other associated countries, provided certain conditions are met).  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |
| *Policy Trackers* | Climate Action 40%  Digital: 0%  Biodiversity: 0% |

Expected outcomes:

* Support the EU space policy and the green deal by providing the detailed definition of a quantum space gravimetry pathfinder mission
* Ensure EU sovereignty and non-dependence for the development of capacities leading to the availability of quantum space gravimetry
* Enhance the TRL of the critical components necessary to build quantum gravimetry for space

These outcomes will contribute to securing the autonomy of supply for critical technologies and equipment, and fostering the EU's space sector competitiveness, in line with the Expected Impact of the destination.

One proposal for this Phase-B study and the associated technology maturation will be selected.

Scope: The final objective of this call is to prepare the next phases of the implementation of a Quantum Space Gravimetry pathfinder mission. To achieve this objective, one proposal for a phase B study, as specified in ECSS‐M‐ST‐10C, leading to a preliminary definition of a quantum space gravimetry pathfinder mission, will be selected. This activity will cover both the quantum space gravimetry payload and satellite platform. This activity will also include the implementation measures that will enhance the technological readiness of the critical components leading to TRL 6/7 at the end of the project. The proposals will detail the reviews organised under the study. These reviews, organised by the consortium, will be open to COM and ESA experts. The Phase B will conclude with a Preliminary Design Review. .

It is expected to fund one study.

Annex: QSG Pathfinder mission statement

2023 - Space Weather and Near Earth Objects

a) Space Weather

The worldwide goal of space weather activities should be to monitor and forecast SWE just like terrestrial weather. However, direct physical simulation is currently not achievable for an operational Sun to Earth system, due in part to the lack of measurements and to the complexity of the involved processes, as well as different timescales involved. Current space weather models are generally not capable of forecasting events over several days. A longer forecasting horizon would require access to data from new observation infrastructure coupled with new and improved modelling capabilities.

Research and innovation activities under this area will be delegated to ESA and will deal with “development of certain technology elements for promising precursor services” and “exploratory space weather payloads studies”. They shall be complementarity to Space Weather services developed through the Space Situational Awareness component of the EU Space Programme.

b) Near Earth Objects

Our knowledge of the physical characteristics of the NEO population is limited. And there is a need of continuously investigate and share the physical and dynamical properties of the NEO population as a whole, either through ground-based observations or through missions to asteroids (e.g. close proximity operations to NEOs or mitigation demonstration). It is necessary to have a number of specific technologies and instruments readily available to further strengthening the science return of a mission.

Research and innovation activities under this area will be delegated to ESA and will study “precursor services / European hot-redundant Minor Planet Centre backup” and “Increase networking of MS assets”.

Other Actions - Indirectly managed actions delegated to ESA

Budget: between EUR 5 and 6 million from the 2024 budget.

## 5.6 Space Other Actions

1) HORIZON-CL4-2024-SPACE-01-51-SST-MS: New & improved EUSST Missions and Services (RIA)

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| --- | --- | --- |
| *YEAR* | | 2024 |
| **Specific conditions** | | |
| *Expected EU contribution per project* | One project.  The Commission estimates that an EU contribution of EUR [xx] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is between EUR 4 and 8 million. | |
| *Type of Action* | Research and Innovation Action (RIA)  Grant awarded without call for proposals according to Financial Regulation Article 195 (d) | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exceptions apply:  **Lower funding rates**  As justified in the Implementing Act related to Space regulation Article 58 §8: the philosophy of EUSST is to use national assets which has been built by Member States in order to tackle national needs. While playing national roles, the data collected by these assets can be used in order to provide EUSST services.  **Standard deliverables**  Grants award under this topic will have to submit the following deliverable(s):   1. Metrics and KPI (Key Performance Indicators) description 2. KPI flash report (to be submitted every quarter) 3. Security sensitive information assessment report (to be submitted at the beginning, at mid-term and towards the end of the project) 4. data management plan (to be submitted at the beginning, at mid-term and towards the end of the project) 5. communication plan (to be submitted at beginning of the project) 6. plan for the dissemination and exploitation of results (to be submitted at the beginning, at mid-term and towards the end of the project).   **Unlimited subcontracting**  Subcontracting is not restricted to a limited part of the action.  **Depreciation and full costs for listed equipment eligible**  Purchases of equipment, infrastructure or other assets used for the action must be declared as depreciation costs. Moreover, for the following equipment, infrastructure or other assets purchased specifically for the action (or developed as part of the action tasks): sensors and operational centres building blocks constituting the current and future EUSST architecture, costs may exceptionally be declared as full capitalised costs.  **Right to object to transfers or licensing**  The granting authority may object to a transfer of ownership or the licensing of results under certain conditions.  **Additional information obligation relating to standards**  The beneficiaries must inform the granting authority if the results could reasonably be expected to contribute to European or international standards. | |
| *Eligibility conditions* | **Participation limited to legal entities established in Member States only**  In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, or security, namely safe, secure and sustainable access to, operations in and return from outer space, participation is limited to legal entities established in Member States only. Proposals including entities established in countries outside the scope specified in the call/topic/action will be ineligible.  Participation is further limited to legal entities fulfilling the following conditions:   * be established in a Member State and their executive management structures be established therein, * commit to carry out all relevant activities in one or more Member States, and * be established in a Member State and not be subject to control by a third country or by a third country entity. * For the purpose of this Article, control means the ability to exercise a decisive influence on a legal entity directly or indirectly through one or more intermediate legal entity. * For the purpose of this Article, executive management structure means body of a legal entity appointed in accordance with national law, and, where applicable, reporting to the chief executive officer, or any other person having comparable decisional power, which is empowered to establish the legal entity's strategy, objectives and overall direction, and which oversees and monitors management decision-making.   Some activities, resulting from these actions, may involve using classified background and/or producing of security sensitive results (EUCI and SEN). Please refer to the related provisions in section B Security — EU classified and sensitive information of the General Annexes. | |
| *Lump-sums* | **NO** | |
| *Admissibility conditions* | The page limit of the application is 100 pages per topic/action. | |
| *Award criteria* | The proposed project should provide a coherent contribution to the EUSST development plan as the projects to be awarded in this area are all expected to support the improvement of the current EUSST services or the implementation of new ones.  **Mandatory use of Copernicus and Galileo/EGNOS data for projects using satellite-based earth observation, positioning, navigation and/or timing data and services.**  If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used). | |
| *Key Policy Trackers* | Climate Action: 0%  Digital: 100%  Biodiversity: 0% | |
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Expected Outcomes:

In the coming years, an increase in the number of active objects in orbit is foreseen (e.g. deployment of mega-constellations, increased number of non-manoeuvrable small objects – SmallSats for research and scientific purposes, etc.). Additionally, the number of objects (active and inactive) to be handled by SST systems will also increase due to the use of sensors with a higher detection capability. For example, the US Space Fence radar, declared operational in March 2020, is capable of detecting and tracking objects smaller than 10 centimetres and is expected to considerably increase the size of the space objects catalogue of the US Space Surveillance Network.

Consequently, the provision of services by the EUSST operation centres, as well as the strategy used to protect the European active satellites will have to be adapted to the arising needs. The need for the development of automated concepts becomes more relevant in order to reduce response times, reduce costs and simplify coordination activities amongst operators.

Therefore, R&I projects on “*new and improved EUSST missions and services*” are expected to contribute to the following outcomes:

* Keep the knowledge and capabilities of Europe on the Space Surveillance and Tracking domain at the leading edge.
* Adapt, improve and evolve the current EUSST initial services (Collision Avoidance; Fragmentation; Re-entry) portfolio to future user needs and space environment.
* Improve the overall performance of the EUSST services and ensure, in the long-term, a high level of performance and appropriate autonomy at Union level.
* Identify and define new missions and services (e.g. debris mitigation; debris remediation).
* Explore the implementation of new services, in complement of the three existing ones.
* Support the pre-developments and end-to-end early demonstration of new SST services.

Scope:

R&I activities which needs to be addressed in order to tackle the above expected outcomes are the following: [to be developed]

1. R&I on evolution of the Collision Avoidance service towards a higher responsiveness in the case of risks (e.g. Automatic warning service), and in all phases of the spacecraft life (e.g. deorbiting, EOL, etc.),
2. R&I on evolution of the EUSST system for **debris mitigation** in order to reduce the space debris generation,
3. R&I on evolution of the EUSST System for space **debris remediation** by managing the existing space debris.
4. R&I on evolution of the EUSST Service Provision Portal in line with the evolution of the existing services (CA, RE, FG) and the inclusion of additional new ones (Debris mitigation / remediation).

As the legal entities identified below are bodies designated by Member States, under their responsibility, to participate in the SST Partnership within the meaning of Articles 56 & 57 of the “Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme”, and under the same Regulation the Member States are identified as beneficiaries, this grant is awarded without a call for proposals in accordance with Article 195(d) of the EU Financial Regulation 2018/1046 and Article 20 of the Horizon Europe Framework Programme and Rules for Participation.

Legal entities: The Constituting National Entities having concluded an agreement creating the SST partnership

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant awarded without call for proposals according to Financial Regulation Article 195 (d) - identified beneficiary -

2) HORIZON-CL4-2024-SPACE-01-52-SST-AE: SST & STM system architecture and evolutions (RIA)

|  |  |  |
| --- | --- | --- |
| *YEAR* | | 2024 |
| **Specific conditions** | | |
| *Expected EU contribution per project* | One project.  The Commission estimates that an EU contribution of EUR [xx] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is between EUR 4 and 6 million. | |
| *Type of Action* | Research and Innovation Action (RIA)  Grant awarded without call for proposals according to Financial Regulation Article 195 (d) | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exceptions apply:  **Lower funding rates**  As justified in the Implementing Act related to Space regulation Article 58 §8: the philosophy of EUSST is to use national assets which has been built by Member States in order to tackle national needs. While playing national roles, the data collected by these assets can be used in order to provide EUSST services.  **Standard deliverables**  Grants award under this topic will have to submit the following deliverable(s):   1. Metrics and KPI (Key Performance Indicators) description 2. KPI flash report (to be submitted every quarter) 3. Security sensitive information assessment report (to be submitted at the beginning, at mid-term and towards the end of the project) 4. data management plan (to be submitted at the beginning, at mid-term and towards the end of the project) 5. communication plan (to be submitted at beginning of the project) 6. plan for the dissemination and exploitation of results (to be submitted at the beginning, at mid-term and towards the end of the project).   **Unlimited subcontracting**  Subcontracting is not restricted to a limited part of the action.  **Depreciation and full costs for listed equipment eligible**  Purchases of equipment, infrastructure or other assets used for the action must be declared as depreciation costs. Moreover, for the following equipment, infrastructure or other assets purchased specifically for the action (or developed as part of the action tasks): sensors and operational centres building blocks constituting the current and future EUSST architecture, costs may exceptionally be declared as full capitalised costs.  **Right to object to transfers or licensing**  The granting authority may object to a transfer of ownership or the licensing of results under certain conditions.  **Additional information obligation relating to standards**  The beneficiaries must inform the granting authority if the results could reasonably be expected to contribute to European or international standards. | |
| *Eligibility conditions* | **Participation limited to legal entities established in Member States only**  In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, or security, namely safe, secure and sustainable access to, operations in and return from outer space, participation is limited to legal entities established in Member States only. Proposals including entities established in countries outside the scope specified in the call/topic/action will be ineligible.  Participation is further limited to legal entities fulfilling the following conditions:   * be established in a Member State and their executive management structures be established therein, * commit to carry out all relevant activities in one or more Member States, and * be established in a Member State and not be subject to control by a third country or by a third country entity. * For the purpose of this Article, control means the ability to exercise a decisive influence on a legal entity directly or indirectly through one or more intermediate legal entity. * For the purpose of this Article, executive management structure means body of a legal entity appointed in accordance with national law, and, where applicable, reporting to the chief executive officer, or any other person having comparable decisional power, which is empowered to establish the legal entity's strategy, objectives and overall direction, and which oversees and monitors management decision-making.   Some activities, resulting from these actions, may involve using classified background and/or producing of security sensitive results (EUCI and SEN). Please refer to the related provisions in section B Security — EU classified and sensitive information of the General Annexes. | |
| *Lump-sums* | **NO** | |
| *Admissibility conditions* | The page limit of the application is 100 pages per topic/action. | |
| *Award criteria* | The proposed project should provide a coherent contribution to the EUSST development plan as the projects to be awarded in this area are all expected to support the improvement of the current EUSST services or the implementation of new ones.  **Mandatory use of Copernicus and Galileo/EGNOS data for projects using satellite-based earth observation, positioning, navigation and/or timing data and services.**  If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used). | |
| *Key Policy Trackers* | Climate Action: 0%  Digital: 100%  Biodiversity: 0% | |
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Expected Outcomes:

The environment on which the EUSST system performs its mission and delivers its services is in constant evolution (e.g. technological or political factors changing the way on which the space is used, orbital environment …).

EUSST system architecture engineering & evolutions: the analysis of the EU SST system architecture needs to continuously progress to evaluate how the system has to evolve at medium and long term, not only at network level (type, performance, number, geographical localisation... of assets) but also at data processing and at services level. Other aspects like data flow, security constraints, interconnectivity and complementarity between EU assets but also cooperation with other non-European SST systems, etc. need to be considered as well.

More generally, the reliance on space-based data and services, in particular thanks to the success of Copernicus and Galileo European programmes and the forthcoming connectivity constellation, for our society, economy, security and defence has been rapidly growing. At the same time, the emergence of new type of actors and business models (e.g. mega constellation) increases the number of satellites and debris in orbit. For this reason, space becomes more and more congested, posing a threat to the sustainability and safety of space operations and infrastructures, with a higher risk of collision and of radiofrequency interferences.

The importance of SST / Space Traffic Management (STM) is thus growing, in a context where there is lack of a clear definition at international level and no global regime and system is in place, neither are flight rules and the associated monitoring/enforcement means.

Therefore projects developed under this topic are expected to contribute to the following outcomes:

* Foster European cooperation in the SST domain and improve the EUSST performance towards larger autonomy.
* Highlight and propose solutions to fill the gaps in the current EUSST architecture.
* Pave the way on which the EUSST system has to evolve towards a higher level of performance (e.g. accuracy; number / size of catalogued objects...), quality of service (e.g. timeliness of information...) and autonomy.
* Demonstrate the complementarity, coherence and added-value of each element of EUSST system towards a more autonomous, interoperable SST system.
* Explore and look for higher levels of cooperation with other SST systems such as the US SSA system which is of paramount importance to develop long-term cooperation.
* Raise the main issues and propose relevant answers to questions posed by all those developments in various technical and operational domains based on the outcome of the previous STM coordination and support actions developed under H2020.
* Propose adaptation to the new changes, and solutions for their possible integration into the existing standards, practices and technological means.

Scope:

R&I activities which needs to be addressed in order to tackle the above expected outcomes are the following: [to be developed]

As the legal entities identified below are bodies designated by Member States, under their responsibility, to participate in the SST Partnership within the meaning of Articles 56 & 57 of the “Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme”, and under the same Regulation the Member States are identified as beneficiaries, this grant is awarded without a call for proposals in accordance with Article 195(d) of the EU Financial Regulation 2018/1046 and Article 20 of the Horizon Europe Framework Programme and Rules for Participation.

Legal entities: The Constituting National Entities having concluded an agreement creating the SST partnership

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant awarded without call for proposals according to Financial Regulation Article 195 (d) - identified beneficiary -

3) HORIZON-CL4-2024-SPACE-01-53-SST-SB: Space-based SST (mission, system and sensors network) (RIA)

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| --- | --- | --- |
| *YEAR* | | 2024 |
| **Specific conditions** | | |
| *Expected EU contribution per project* | One project.  The Commission estimates that an EU contribution of EUR [xx] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is between EUR 7 and 13 million from the 2024 budget. | |
| *Type of Action* | Research and Innovation Action (RIA)  Grant awarded without call for proposals according to Financial Regulation Article 195 (d) | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exceptions apply:  **Lower funding rates**  As justified in the Implementing Act related to Space regulation Article 58 §8: the philosophy of EUSST is to use national assets which has been built by Member States in order to tackle national needs. While playing national roles, the data collected by these assets can be used in order to provide EUSST services.  **Standard deliverables**  Grants award under this topic will have to submit the following deliverable(s):   1. Metrics and KPI (Key Performance Indicators) description 2. KPI flash report (to be submitted every quarter) 3. Security sensitive information assessment report (to be submitted at the beginning, at mid-term and towards the end of the project) 4. data management plan (to be submitted at the beginning, at mid-term and towards the end of the project) 5. communication plan (to be submitted at beginning of the project) 6. plan for the dissemination and exploitation of results (to be submitted at the beginning, at mid-term and towards the end of the project).   **Unlimited subcontracting**  Subcontracting is not restricted to a limited part of the action.  **Depreciation and full costs for listed equipment eligible**  Purchases of equipment, infrastructure or other assets used for the action must be declared as depreciation costs. Moreover, for the following equipment, infrastructure or other assets purchased specifically for the action (or developed as part of the action tasks): sensors and operational centres building blocks constituting the current and future EUSST architecture, costs may exceptionally be declared as full capitalised costs.  **Right to object to transfers or licensing**  The granting authority may object to a transfer of ownership or the licensing of results under certain conditions.  **Additional information obligation relating to standards**  The beneficiaries must inform the granting authority if the results could reasonably be expected to contribute to European or international standards. | |
| *Eligibility conditions* | **Participation limited to legal entities established in Member States only**  In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, or security, namely safe, secure and sustainable access to, operations in and return from outer space, participation is limited to legal entities established in Member States only. Proposals including entities established in countries outside the scope specified in the call/topic/action will be ineligible.  Participation is further limited to legal entities fulfilling the following conditions:   * be established in a Member State and their executive management structures be established therein, * commit to carry out all relevant activities in one or more Member States, and * be established in a Member State and not be subject to control by a third country or by a third country entity. * For the purpose of this Article, control means the ability to exercise a decisive influence on a legal entity directly or indirectly through one or more intermediate legal entity. * For the purpose of this Article, executive management structure means body of a legal entity appointed in accordance with national law, and, where applicable, reporting to the chief executive officer, or any other person having comparable decisional power, which is empowered to establish the legal entity's strategy, objectives and overall direction, and which oversees and monitors management decision-making.   Some activities, resulting from these actions, may involve using classified background and/or producing of security sensitive results (EUCI and SEN). Please refer to the related provisions in section B Security — EU classified and sensitive information of the General Annexes. | |
| *Lump-sums* | **NO** | |
| *Admissibility conditions* | The page limit of the application is 100 pages per topic/action. | |
| *Award criteria* | The proposed project should provide a coherent contribution to the EUSST development plan as the projects to be awarded in this area are all expected to support the improvement of the current EUSST services or the implementation of new ones.  **Mandatory use of Copernicus and Galileo/EGNOS data for projects using satellite-based earth observation, positioning, navigation and/or timing data and services.**  If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used). | |
| *Key Policy Trackers* | Climate Action: 0%  Digital: 100%  Biodiversity: 0% | |
|  |  |  |

Expected Outcomes:

With the increase of the orbital population and with the need of observing smaller objects to better protect the EU space assets, the need and added-value of developing Space-Based Space Surveillance (SBSS) missions in complement to ground SST networks shall be studied in Europe. Based on the experience of SBSS missions launched and operated outside Europe (e.g. by US and Canada), Space-based SST missions and sensors network will have to be included in EUSST in order to increase the EU ability to observe and catalogue objects on various orbits, and compensate for the limitation linked to the geographical location, light and weather conditions of ground sensors.

Therefore projects developed under this topic are expected to contribute to the following outcomes:

1. Study and assess several technical solutions for the development of a future European capability of SBSS.
2. Explore the use of small satellite solutions to reduce CAPEX and OPEX
3. To develop in the mid-term the European capacity to operate independently SBSS.
4. To reduce the dependence on critical SBSS technologies and capabilities from outside Europe,

Scope:

R&I activities which needs to be addressed in order to tackle the above expected outcomes are the following: [to be developed]

As the legal entities identified below are bodies designated by Member States, under their responsibility, to participate in the SST Partnership within the meaning of Articles 56 & 57 of the “Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme”, and under the same Regulation the Member States are identified as beneficiaries, this grant is awarded without a call for proposals in accordance with Article 195(d) of the EU Financial Regulation 2018/1046 and Article 20 of the Horizon Europe Framework Programme and Rules for Participation.

Legal entities: The Constituting National Entities having concluded an agreement creating the SST partnership

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant awarded without call for proposals according to Financial Regulation Article 195 (d) - identified beneficiary -

4) HORIZON-CL4-2024-SPACE-01-54-SST-SP: SST Sensors and Processing (IA)

|  |  |  |
| --- | --- | --- |
| *YEAR* | | 2024 |
| **Specific conditions** | | |
| *Expected EU contribution per project* | One project.  The Commission estimates that an EU contribution of EUR [xx] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is between EUR 24 and 30 million. | |
| *Type of Action* | Innovation Action (IA) with a reduced funding rate (45%)  Grant awarded without call for proposals according to Financial Regulation Article 195 (d) | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exceptions apply:  **Lower funding rates**  As justified in the Implementing Act related to Space regulation Article 58 §8: the philosophy of EUSST is to use national assets which has been built by Member States in order to tackle national needs. While playing national roles, the data collected by these assets can be used in order to provide EUSST services.  **Standard deliverables**  Grants award under this topic will have to submit the following deliverable(s):   1. Metrics and KPI (Key Performance Indicators) description 2. KPI flash report (to be submitted every quarter) 3. Security sensitive information assessment report (to be submitted at the beginning, at mid-term and towards the end of the project) 4. data management plan (to be submitted at the beginning, at mid-term and towards the end of the project) 5. communication plan (to be submitted at beginning of the project) 6. plan for the dissemination and exploitation of results (to be submitted at the beginning, at mid-term and towards the end of the project).   **Unlimited subcontracting**  Subcontracting is not restricted to a limited part of the action.  **Depreciation and full costs for listed equipment eligible**  Purchases of equipment, infrastructure or other assets used for the action must be declared as depreciation costs. Moreover, for the following equipment, infrastructure or other assets purchased specifically for the action (or developed as part of the action tasks): sensors and operational centres building blocks constituting the current and future EUSST architecture, costs may exceptionally be declared as full capitalised costs.  **Right to object to transfers or licensing**  The granting authority may object to a transfer of ownership or the licensing of results under certain conditions.  **Additional information obligation relating to standards**  The beneficiaries must inform the granting authority if the results could reasonably be expected to contribute to European or international standards. | |
| *Eligibility conditions* | **Participation limited to legal entities established in Member States only**  In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, or security, namely safe, secure and sustainable access to, operations in and return from outer space, participation is limited to legal entities established in Member States only. Proposals including entities established in countries outside the scope specified in the call/topic/action will be ineligible.  Participation is further limited to legal entities fulfilling the following conditions:   * be established in a Member State and their executive management structures be established therein, * commit to carry out all relevant activities in one or more Member States, and * be established in a Member State and not be subject to control by a third country or by a third country entity. * For the purpose of this Article, control means the ability to exercise a decisive influence on a legal entity directly or indirectly through one or more intermediate legal entity. * For the purpose of this Article, executive management structure means body of a legal entity appointed in accordance with national law, and, where applicable, reporting to the chief executive officer, or any other person having comparable decisional power, which is empowered to establish the legal entity's strategy, objectives and overall direction, and which oversees and monitors management decision-making.   Some activities, resulting from these actions, may involve using classified background and/or producing of security sensitive results (EUCI and SEN). Please refer to the related provisions in section B Security — EU classified and sensitive information of the General Annexes. | |
| *Lump-sums* | **NO** | |
| *Admissibility conditions* | The page limit of the application is 100 pages per topic/action. | |
| *Award criteria* | The proposed project should provide a coherent contribution to the EUSST development plan as the projects to be awarded in this area are all expected to support the improvement of the current EUSST services or the implementation of new ones.  **Mandatory use of Copernicus and Galileo/EGNOS data for projects using satellite-based earth observation, positioning, navigation and/or timing data and services.**  If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used). | |
| *Key Policy Trackers* | Climate Action: 0%  Digital: 100%  Biodiversity: 0% | |
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Expected outcomes: Projects are expected to contribute to the following outcomes:

Supporting the upgrade and development of on-ground assets, in particular radars and telescopes as well as data processing.

SST radiofrequency & optical sensors (radars, telescopes…) technological research & innovation: due to the increased number of objects (both active and debris) to be handled, as well as the evolution and inclusion of services in the future, R&I activities are necessary in the sensor domain, both for radiofrequency (e.g. passive ranging, radars, etc.) and optical sensors (e.g. telescopes, innovative wide field optical sensors, lasers). New promising technologies like sensors based on the use of infrared will also be considered.

* Contribution to a consolidated and efficient EUSST sensor function.
* Improve coverage area, geographical location and performance they can offer: e.g. field of view, limiting magnitude, frequency-band, accuracy, timeliness of the associated processing ...
* Ensure an optimum evolution of the configuration and use of the EUSST sensors network, including the necessary raw data processing required to provide measurement data.
* Improved integration and connectivity of value added sensors, ensuring their compliance to the minimum quality requirements (including protocols, procedures, formats and calibration status).

SST data processing research & innovation (e.g. Artificial Intelligence…): the changes and evolution in the space environment impose the need of adapting the current algorithms and data processing methods and tools, as well as to look for new one.

* Include or at least explore the possibility to use Artificial Intelligence (AI) in any SST data processing (e.g. Improvement of object detection capability; of probability of collision accuracy ...)
* Development of automatic sensor scheduling and tasking, and data processing functions

Scope: To ensure that the sensors and data processing used in the SST domain can properly address the upcoming requirements in all aspects, the following R&I activities needs to be addressed in order to tackle the above expected outcomes: [to be developed]

As the legal entities identified below are bodies designated by Member States, under their responsibility, to participate in the SST Partnership within the meaning of Articles 56 & 57 of the “Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme”, and under the same Regulation the Member States are identified as beneficiaries, this grant is awarded without a call for proposals in accordance with Article 195(d) of the EU Financial Regulation 2018/1046 and Article 20 of the Horizon Europe Framework Programme and Rules for Participation.

Legal entities: The Constituting National Entities having concluded an agreement creating the SST partnership

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant awarded without call for proposals according to Financial Regulation Article 195 (d)

5) HORIZON-CL4-2024-SPACE-01-55-SST-SD: SST Networking, Security & Data sharing (RIA)

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| --- | --- | --- |
| *YEAR* | | 2024 |
| **Specific conditions** | | |
| *Expected EU contribution per project* | One project.  The Commission estimates that an EU contribution of EUR [xx] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is between EUR 5 and 9 million. | |
| *Type of Action* | Research & Innovation Action (RIA)  Grant awarded without call for proposals according to Financial Regulation Article 195 (d) | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 6-7 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exceptions apply:  **Lower funding rates**  As justified in the Implementing Act related to Space regulation Article 58 §8: the philosophy of EUSST is to use national assets which has been built by Member States in order to tackle national needs. While playing national roles, the data collected by these assets can be used in order to provide EUSST services.  **Standard deliverables**  Grants award under this topic will have to submit the following deliverable(s):   1. Metrics and KPI (Key Performance Indicators) description 2. KPI flash report (to be submitted every quarter) 3. Security sensitive information assessment report (to be submitted at the beginning, at mid-term and towards the end of the project) 4. data management plan (to be submitted at the beginning, at mid-term and towards the end of the project) 5. communication plan (to be submitted at beginning of the project) 6. plan for the dissemination and exploitation of results (to be submitted at the beginning, at mid-term and towards the end of the project).   **Unlimited subcontracting**  Subcontracting is not restricted to a limited part of the action.  **Depreciation and full costs for listed equipment eligible**  Purchases of equipment, infrastructure or other assets used for the action must be declared as depreciation costs. Moreover, for the following equipment, infrastructure or other assets purchased specifically for the action (or developed as part of the action tasks): sensors and operational centres building blocks constituting the current and future EUSST architecture, costs may exceptionally be declared as full capitalised costs.  **Right to object to transfers or licensing**  The granting authority may object to a transfer of ownership or the licensing of results under certain conditions.  **Additional information obligation relating to standards**  The beneficiaries must inform the granting authority if the results could reasonably be expected to contribute to European or international standards. | |
| *Eligibility conditions* | **Participation limited to legal entities established in Member States only**  In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, or security, namely safe, secure and sustainable access to, operations in and return from outer space, participation is limited to legal entities established in Member States only. Proposals including entities established in countries outside the scope specified in the call/topic/action will be ineligible.  Participation is further limited to legal entities fulfilling the following conditions:   * be established in a Member State and their executive management structures be established therein, * commit to carry out all relevant activities in one or more Member States, and * be established in a Member State and not be subject to control by a third country or by a third country entity. * For the purpose of this Article, control means the ability to exercise a decisive influence on a legal entity directly or indirectly through one or more intermediate legal entity. * For the purpose of this Article, executive management structure means body of a legal entity appointed in accordance with national law, and, where applicable, reporting to the chief executive officer, or any other person having comparable decisional power, which is empowered to establish the legal entity's strategy, objectives and overall direction, and which oversees and monitors management decision-making.   Some activities, resulting from these actions, may involve using classified background and/or producing of security sensitive results (EUCI and SEN). Please refer to the related provisions in section B Security — EU classified and sensitive information of the General Annexes. | |
| *Lump-sums* | **NO** | |
| *Admissibility conditions* | The page limit of the application is 100 pages per topic/action. | |
| *Award criteria* | The proposed project should provide a coherent contribution to the EUSST development plan as the projects to be awarded in this area are all expected to support the improvement of the current EUSST services or the implementation of new ones.  **Mandatory use of Copernicus and Galileo/EGNOS data for projects using satellite-based earth observation, positioning, navigation and/or timing data and services.**  If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used). | |
| *Key Policy Trackers* | Climate Action: 0%  Digital: 100%  Biodiversity: 0% | |
|  |  |  |

Expected outcomes: Projects are expected to contribute to the following outcomes:

The topic “SST Networking, Security & Data sharing” aims to support the upgrade, development and security issues of EUSST infrastructure based on the European network of assets (sensors, operation centres, front desk …).

Although the EUSST infrastructure is supposed to stay under national control (meaning mainly sensors and operation centres), an increased coordination is needed due to the increased number of assets contributing to the European SST system. Without this interconnection and coordination, it is impossible to ensure an efficient use of the resources and an appropriate response to the challenges posed by the changing space environment.

As concrete aspects of the EUSST network (e.g. pooling of data from multiple sensor sources; exchange between multiple operations centres of Member States) shall be considered in highly detailed case studies, modelling.

SST networking of sensors & operation centres (EU SST network Command & Control): considering the increased number of objects to be handled, an increased number of events and users is expected. The European SST system has to evolve to a coordinated scheduling of the resources and assets, ensuring that the events are covered in an optimum way, while the current survey and tracking of the space objects population continues to be performed. Evolution of the European SST network includes the Front Desk in charge of the interaction with the users (users’ needs, monitoring of the service performance, etc.).

* Raise the main issues and propose relevant answers to the increasing complexity and missions constraints of the EUSST network.
* Connectivity and interface consolidation of network function between sensors / database / operating centres / front desk (reliability, maintainability and agility).
* Develop EUSST network in order to include a future new SBSS segment.

Research on EUSST network hardening against external threats: the research concerns security-critical aspects of the existing EU SST network. Various external threats shall be considered in the research activity (e.g. cyber threats or other malicious activity). Research specifically applying to the hardening of the EU SST network could add value to existing research on network hardening that looks at computer networks and other related networks more generally.

* A secured and resilient EUSST infrastructure.
* Next generation exchange protocols / solutions for SSA enhancing interoperability and security (robustness, information assurance, intrusion detection…)
* Define the need for SST-specific tools and solutions with regard to enhanced data interoperability and data security.

Scope: the following R&I activities need to be addressed in order to tackle the above expected outcomes: [to be developed]

As the legal entities identified below are bodies designated by Member States, under their responsibility, to participate in the SST Partnership within the meaning of Articles 56 & 57 of the “Regulation of the European Parliament and of the Council establishing the space programme of the Union and the European Union Agency for the Space Programme”, and under the same Regulation the Member States are identified as beneficiaries, this grant is awarded without a call for proposals in accordance with Article 195(d) of the EU Financial Regulation 2018/1046 and Article 20 of the Horizon Europe Framework Programme and Rules for Participation.

Legal entities: The Constituting National Entities having concluded an agreement creating the SST partnership

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant awarded without call for proposals according to Financial Regulation Article 195 (d) - identified beneficiary -

6) 2023-Innovation activities for improved EGNSS operation and service provision

The improvement of the complex operations is essential to improve the performance of EGNSS services. Likewise, maintenance activities must be subject to a continuous improvement process to guarantee the service continuity. Actions under this area will cover the development and use of service demonstrators to consolidate the future EGNSS services, the optimization of the operation schemes using advanced dynamic strategies (e.g. machine learning, advanced on-board diagnosis, predictive maintenance) for Galileo constellation / system management for the efficient and continuous provision of the full portfolio of Services in EGNOS and in Galileo, and others.

These activities will be implemented by EUSPA under the Contribution Agreement between the Commission and EUSPA. The procurement actions under this section will affect the essential security interests of the Union, and will therefore require restricted participation that will be established in the tender specifications. In such case participation should in principle be open only to entities established in the EU Member States. Participation of entities established in Horizon Europe associated countries or in third countries will be decided on a case by case basis with the approval of the annual work plan submitted to Commission under the Financial Framework Partnership Agreement (FFPA).

Indicative budget for this action: EUR 4 to 6 million from the 2023 budget.

7) 2023-2024-EGNSS Evolution: Technology and infrastructure-related R&D activities

Actions under this area will address upstream R&D activities. They will cover the maturing of the existing technologies and the development of new and emerging technologies, the engineering activities for the further evolution of Galileo and EGNOS existing systems, technical studies for the assessment of exploratory system concepts and/or responding to new mission needs and a changing environment, the development and maintenance of state-of-art system tools and technical test-beds, the implementation of actions agreed at Programme level to reduce the dependence of the supply chain on non-EU markets, the definition, design, development and implementation of experimental satellite demonstrator, and others.

These activities will be implemented by ESA under the Contribution Agreement between the Commission and ESA. The procurement actions under this section will affect the essential security interests of the Union, and will therefore require restricted participation that will be established in the tender specifications. In such case, participation should in principle be open only to entities established in the EU Member States. Participation of entities established in Horizon Europe associated countries or in third countries will be decided on a case by case basis with the approval of the annual work plan submitted to Commission under the Financial Framework Partnership Agreement (FFPA).

Indicative budget for this action: EUR 40 to 55 million from the 2023 budget and EUR 40 to 55 million from the 2024 budget.

8) 2024-EGNSS Evolution: Mission and Service-related R&D activities

The objective is to study potential new user needs, as well as the resulting enhancement of services, and determine whether and how the EGNSS programmes Galileo and EGNOS shall evolve to answer these new user needs. This includes the preparation of contributions and technical analysis supporting the EU position in multilateral and bilateral working groups and meetings.

The upstream R&D actions in this area will cover the assessment of new mission concepts and of services improvements and of new services or capacities to be introduced based on the user needs, developing the service concept including with international partners when relevant, assessing costs to the programme versus benefits to users and defining the roadmap of activities until an operational service could be provided.

Some procurement actions under this section will affect the essential security interests of the Union, and will therefore require restricted participation that will be established in the tender specifications on a case-by-case basis.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: Q3-Q4 2024

Indicative budget: EUR 2 to 3 million from the 2023 budget, EUR 2 to 3 million from the 2024 budget.

### 9) 2023-2024 Secure Connectivity/GOVSATCOM Space infrastructure: Development and Validation

The Commission has adopted a proposal for a Union Programme for Secure Connectivity. The future satellite based communication infrastructure should build upon the GOVSATCOM component of the Union Space Programme, which should also take advantage of additional national and European capacities, and develop further the European Quantum Communication Infrastructure (EuroQCI) initiative.

This action should therefore enable and support the development and validation actions for the construction of the initial space and ground infrastructure required for the provision of governmental services.

These activities are due to be supervised by ESA under a Contribution Agreement between the Commission and ESA. The procurement actions under this section will affect the essential security interests of the Union, and will therefore require restricted participation that will be established in the tender specifications. In such case, participation should in principle be open only to entities established in the EU Member States. Participation of entities established in Horizon Europe associated countries or in third countries will be decided on a case by case basis.

Indicative budget for this action: minimum EUR 15 to 25 million from the 2024 budget.

### 10) 2023-2024 Secure Connectivity/GOVSATCOM Upstream technology R&D activities

A number of key technology needs have been identified in order to provide state of the art GOVSATCOM services, either through the GOVSATCOM pooling and sharing HUB or through a new secure connectivity infrastructure. These activities will be implemented by ESA under Contribution Agreement between the Commission and ESA.

The upstream R&D actions in this area will cover development of critical building blocks in the space segment (e.g. in Ku, Ka, Q/V frequency bands), ground control and mission (network) segment and user segment terminals, such as multi-orbit compatible broadband user terminals and government services user terminals.

These activities are due to be supervised by ESA under a Contribution Agreement between the Commission and ESA. The procurement actions under this section will affect the essential security interests of the Union, and will therefore require restricted participation that will be established in the tender specifications. In such case, participation should in principle be open only to entities established in the EU Member States. Participation of entities established in Horizon Europe associated countries or in third countries will be decided on a case by case basis.

Indicative budget for this action: EUR 8 to 12 million from the 2023 budget.

11) In Orbit Demonstration/Validation (IOD/IOV) service

To ensure EU non-dependence and competitiveness in technologies, there is a clear need for a regular, sustainable, cost-effective and responsive In Orbit Demonstration/Validation (IOD/IOV) service in the EU. Space flight heritage in real conditions and environment is often required to de-risk new technologies, products, concepts, architectures, services and operations techniques be that for unique or recurrent, institutional or commercial missions.

Intended results of the action is to provide a service for regular aggregation (if needed), launch and operations in orbit for IOD/IOV experiments; the objective is to have at least one opportunity every year during the Horizon Europe implementation period. This will contribute to reduce the time to market or operational use of new technologies, products, concepts, architectures, and operations techniques.

The IOD/IOV activities intend to provide a regular and cost-effective service and solution for common flight ticket actions (management, spacecraft design including reuse of existing solutions, assembly, integration and tests, launch and operations) based on EU solutions both for the spacecraft (i.e. platform, experiments aggregation, operations in orbit including preparation and associated Ground Segment) and for the launch services.

The scope of the activities may include mission design, integration and implementation, for all the necessary tasks to prepare, provide and operate spacecraft(s), together with the related ground segment, which accommodates the selected IOD/IOV experiments as well as the associated launch services.

For the aggregation and operations, the activities include:

* System studies, at ground and space level, including the compatibility with the available launchers;
* Input to the launch mission analysis performed by the launch service provider;
* Selection, assembly, integration and testing of the spacecraft(s) and related ground segment;
* Management of interfaces with and between the different IOD/IOV experiments, between the spacecraft and the launcher and between the spacecraft and the ground segment;
* Preparation of the spacecraft(s) for the flight;
* In-orbit testing and operations including data provision.

Concerning launch aspects, IOD/IOV activities should support the European launcher exploitation policy, therefore relying as far as possible on EU manufactured launcher solutions launched from the EU territory. The actions will include the provision of flight opportunities with EU manufactured launchers which encompass the mission analysis, the verification of interfaces between the spacecraft and the launcher, the preparation of launch campaign and the flight up to the injection of the spacecraft(s) on the required orbit(s).

Indicative budget: EUR 13 to 16 million from the 2023 budget and EUR 13 to 16 million from the 2024 budget.

### 12) Support European “New Space” entrepreneurship through CASSINI Space Entrepreneurship Initiative 2021-2027 – Cassini Business Accelerator

Business development, acceleration and upscaling of start-ups will be fostered across all space areas under the CASSINI Space Entrepreneurship Initiative. CASSINI will provide support to business and innovation-friendly ecosystems, including the strengthening business skills in the space market segments and digital services based on space data. The objective is to make start-ups and scale-ups investment-ready and able to secure venture capital funding. Synergies with the InvestEU programme and the Space programme will be established.

Implementation: the action will be implemented by the Commission and EUSPA through a call for tender in 2022 to select a consortium of European business accelerators and sign a service contract for a 2+2 year duration. EUSPA will activate the extension (Year 3+4) of this existing contract with the 2024 Horizon Europe WP.

Amount: The extension of the existing contract for CASSINI Business Accelerator (Year 3+4) will be made by EUSPA in 2024 and the budgetary commitment of EUR 8.50 million from Horizon Europe will be made in 2024.

Expected Outcomes:

* The aims are to promote commercial use cases for the EU’s space programme by providing qualified business development support. The objective is to increase the number of space-based companies that achieve high revenue growth. This will allow the companies to attract investments and capture new market shares.
* The expected economic benefits include an increase in the number of successful start-ups and scale-ups using space data and space technology, through an increase in sales, market share growth and staff hiring. These outcomes will allow the companies to attract larger amounts of financing through bank loans and equity investments.

Form of Funding: Procurement

Type of Action: Public procurement (existing contract)

Indicative budget: between EUR 7 and 10 million from the 2024 budget

### 13) Support European “New Space” entrepreneurship through CASSINI Space Entrepreneurship Initiative 2021-2027 – Cassini Hackatons & Mentoring

Implementation: the action will be implemented by the EUSPA through a call for tender in 2024 for a 2+2 year contract.

Amount: The contract for CASSINI Hackathons & Mentoring (Year 1+2) will be a commitment of EUR 2.4 million on the 2024 Horizon Europe WP.

Expected Outcomes:

* To stimulate the spur-of-the-moment development of innovative applications based on data and information coming from Copernicus satellite images and EGNOS and Galileo positioning signals and services.
* To develop prototypes further into viable business propositions.
* To provide training opportunities on how to access and use data from Copernicus and EGNOS/Galileo with data analytics tools and artificial intelligence.
* To promote the EU’s space programmes Copernicus and EGNOS/Galileo to a broader audience.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative budget: between EUR 2 and 3 million from the 2024 Horizon Europe WP.

## 5.7 Cross-Cutting

HORIZON-CL4-2023-SPACE-01-71: Scientific exploitation of space data

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 9 and 12 million. |
| *Type of Action* | Research and Innovation Actions |
| *Technology Readiness Level* | Activities are expected to achieve TRL3-4 by the end of the project – see General Annex B. |
| *Lump-sums* | Yes |
| *Key Policy Trackers* | Climate Action 0%  Digital 0%  Biodiversity 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Support the data exploitation of European missions and instruments, in conjunction, when relevant, with international missions.
* A higher number of scientific publications based on Europe’s space data, high-level data products made available through appropriate archives, and tools and methods developed for the advanced processing of data. Projects are also expected to add value to existing activities on European and international levels, and to enhance and broaden research partnerships.
* Increased collaboration of scientific teams both within and outside Europe across different domains.
* To strengthen European scientific excellence and support the development of leading edge scientific research in Europe

Scope: Exploitation of all acquired and available data provided by space missions in their operative, post-operative or data exploitation phase ensuring complementarity with activities already supported by ESA or national agencies during development phases.

Given the continuously increasing complexity and volume of these data, this requires innovative data processing technologies (e.g. machine learning, inversion techniques,...), “time series” analysis (which is already common in Earth and Climate Science), joint processing of various (space and ground) data, novel data (re)presentation and visualization assets, as well as sophisticated end-to-end simulations.

Projects may rely on data available through ESA Space Science Archives when possible or other means (e.g. instrumentation teams). Combination and correlation of this data with international scientific mission data, as well as with relevant data produced by ground-based infrastructures all over the world, is encouraged to further increase the scientific return and to enable new research activities using existing data sets. These activities shall add scientific value through analysis of the data, leading to scientific publications and higher level data products, tools and methods. When possible, enhanced data products should be suitable for feeding back into the ESA archives. Resulting analyses should help preparing future European and international missions.

International cooperation is encouraged in particular with countries active in space exploration and space science.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2023-SPACE-01-72: Space technologies for European non-dependence and competitiveness

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 15 and 25 million. |
| *Type of Action* | Research and Innovation Actions |
| *Admissibility conditions* | The conditions are described in General Annex A. The following exceptions apply:  The page limit of the application is 70 pages. |
| *Eligibility conditions* | Art. 22(5) |
| *Technology Readiness Level* | Activities are expected to achieve TRL5/8 (depending on the area addressed, cf. guidance document) by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. The following exceptions apply:  Beneficiaries will be subject to the additional exploitation obligations:  For a period of up to 4 years after the end of the project, access rights to the use of products and/or processes generated by the project shall be given to European entities, in compliance with the signed Grant Agreement and with no legal restrictions and limitations stemming from International Traffic in Arms Regulations (ITAR), EAR99 or equivalent instruments applicable in other jurisdictions.  Applicants must acknowledge and incorporate this obligation in the proposal and Annex I to the Grant Agreement. |
| *Lump-sums* | YES |
| *Article 22(5)* | In accordance with paragraph 11 of Annex IV of the Regulation (EU) 2021/695 establishing Horizon Europe, this action is implemented with regard to eligibility of legal entities in accordance with the Union Space Programme. In particular, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, in order to guarantee the protection of the strategic interests of the Union and its Member States, legal entities established in any Member State will be eligible to participate where these entities comply with the conditions established in Article 24 of the Regulation (EU) 2021/696[[138]](#footnote-139). |
| *Key Policy Trackers* | Climate Action 0%  Digital 40%  Biodiversity 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* To reduce the dependence on critical technologies and capabilities from outside EU for the **EU space programme** **components** (i.e. Galileo/EGNOS, Copernicus, Govsatcom and SSA) and other space applications;
* To develop or regain in the mid-term the European capacity to operate independently in space;
* To enhance the technical capabilities and overall competitiveness of European space industry vendors on the worldwide market;
* To open new competition opportunities for European manufacturers by reducing dependency on export restricted technologies that are of strategic importance to future European space efforts;
* To improve the overall European space technology landscape and complement and/or create synergy with activities of European and national programmes either in the space or non-space fields.

Scope: Research and innovation to mature critical space technologies that currently have dependency issues for use in the EU space programme components and discussed within the frame of the European Commission-ESA-EDA Joint Task Force (JTF).

* High speed DAC-ADC based on European Technology
* High data rate (12.5 to 28 Gbps or higher 56 Gbps), low consumption, short range links
* Enhanced performance and space qualified detectors
* Mid-power range electric propulsion thruster technology
* **[plus Area(s) not addressed by selected proposals in calls 2021-2022, to be added in August 2022]**

Context information and high-level requirements, including description of scope, initial and target TRLs, and, where applicable, references and information of related activities, are provided in the technical guidance document, based on the JTF List of Actions 2021-2023, is published on the Funding & Tenders Portal outlining all relevant information to the selected actions.

Proposals should address only one technology area. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

Technological spin in and/or bilateral collaborations should be enhanced between European non-space and space industries, including technology research institutes and academia.

To achieve the non-dependence objective, applicants should

* Describe the technologies and/or technology processes to be used and show that they are free of any legal export restrictions or limitations, such as those established in the International Traffic in Arms Regulations (ITAR), Export Administration regulation (EAR) such as EAR99 or equivalent instruments applicable in other non-EU jurisdictions;
* Set up a suitable technology development process aiming at avoiding export restrictions of non-EU states and assess vulnerabilities of the supply chain.
* Define tasks as part of the work plan that identify potential critical dependencies of the relevant supply chain from outside EU and a business plan for commercialization, including time to market indication, of the developed product and/or full range of recurring products.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Unless otherwise agreed with the granting authority, beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners or subcontractors are established in countries which are not eligible countries or target countries set out in the call conditions.

HORIZON-CL4-2024-SPACE-01-73: Space technologies for European non-dependence and competitiveness

Restrictions of Article 22.5 will apply

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR xx and xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is between EUR 15 and 25 million. |
| *Type of Action* | Research and Innovation Actions |
| *Admissibility conditions* | The conditions are described in General Annex A. The following exceptions apply:  The page limit of the application is 70 pages. |
| *Technology Readiness Level* | Activities are expected to achieve TRL6/7 (depending on the area addressed, cf. guidance document) by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. The following exceptions apply:  Beneficiaries will be subject to the additional exploitation obligations:  For a period of up to 4 years after the end of the project, access rights to the use of products and/or processes generated by the project shall be given to European entities, in compliance with the signed Grant Agreement and with no legal restrictions and limitations stemming from International Traffic in Arms Regulations (ITAR), EAR99 or equivalent instruments applicable in other jurisdictions.  Applicants must acknowledge and incorporate this obligation in the proposal and Annex I to the Grant Agreement. |
| *Lump-sums* | YES |
| *Article 22(5)* | In accordance with paragraph 11 of Annex IV of the Regulation (EU) 2021/695 establishing Horizon Europe, this action is implemented with regard to eligibility of legal entities in accordance with the Union Space Programme. In particular, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, in order to guarantee the protection of the strategic interests of the Union and its Member States, legal entities established in any Member State will be eligible to participate where these entities comply with the conditions established in Article 24 of the Regulation (EU) 2021/696[[139]](#footnote-140). |
| *Key Policy Trackers* | Climate Action 0%  Digital 40%  Biodiversity 0% |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* To reduce the dependence on critical technologies and capabilities from outside EU for the **EU space programme** **components** (i.e. Galileo/EGNOS, Copernicus, Govsatcom and SSA) and other space applications;
* To develop or regain in the mid-term the European capacity to operate independently in space;
* To enhance the technical capabilities and overall competitiveness of European space industry vendors on the worldwide market;
* To open new competition opportunities for European manufacturers by reducing dependency on export restricted technologies that are of strategic importance to future European space efforts;
* To improve the overall European space technology landscape and complement and/or create synergy with activities of European and national programmes either in the space or non-space fields.

Scope: Research and innovation to mature critical space technologies that currently have dependency issues for use in the EU space programme components and discussed within the frame of the European Commission-ESA-EDA Joint Task Force (JTF).

* Low shock Non-Explosive Actuators (NEA) for smallsats
* Power laser sources in the eye-safe region
* Photonics components
* **[plus Area(s) not addressed by selected proposals in calls 2021-2022, to be added in August 2022]**

Context information and high-level requirements, including description of scope, initial and target TRLs, and, where applicable, references and information of related activities, are provided in the technical guidance document, based on the JTF List of Actions 2021-2023, is published on the Funding & Tenders Portal outlining all relevant information to the selected actions.

Proposals should address only one technology area. To ensure a balanced portfolio covering the areas described above, grants will be awarded to applications not only in order of ranking but at least also to one proposal that is the highest ranked within each area, provided that the applications attain all thresholds.

Technological spin in and/or bilateral collaborations should be enhanced between European non-space and space industries, including technology research institutes and academia.

To achieve the non-dependence objective, applicants should

* Describe the technologies and/or technology processes to be used and show that they are free of any legal export restrictions or limitations, such as those established in the International Traffic in Arms Regulations (ITAR), Export Administration regulation (EAR) such as EAR99 or equivalent instruments applicable in other non-EU jurisdictions;
* Set up a suitable technology development process aiming at avoiding export restrictions of non-EU states and assess vulnerabilities of the supply chain.
* Define tasks as part of the work plan that identify potential critical dependencies of the relevant supply chain from outside EU and a business plan for commercialization, including time to market indication, of the developed product and/or full range of recurring products.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Unless otherwise agreed with the granting authority, beneficiaries must ensure that none of the entities that participate as affiliated entities, associated partners or subcontractors are established in countries which are not eligible countries or target countries set out in the call conditions.

Maximising funding opportunities with the European Innovation Council

This Work Programme contributes to achieving the objectives of the European Innovation Council to identify and support breakthrough technologies and game changing innovations to create new markets and scale up internationally, notably in the area of space upstream and downstream with a view to deploy necessary EIC instruments from pathfinder to transition and accelerator.

Full details on the EIC calls are provided under the Horizon Europe EIC Work Programme 2023 and EIC Work Programme 2024.

# **Destination: A human-centred and ethical development of digital and industrial technologies**

## **Leadership in AI based on Trust**

HORIZON-CL4-2023-HUMAN-01-01: Efficient trustworthy AI - making the best of data (AI, Data and Robotics Partnership) (RIA)

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| --- | --- |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 7 and 9 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [33-37] million. |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *International cooperation* | In order to achieve the expected outcomes, international cooperation is encouraged, in particular with Canada and India. |

There is a need for AI methods that optimize training and reduce the amount data, the intensity of processing and the operations necessary for training high-quality, trustworthy AI systems. As a consequence the energy consumption and the environment footprint will also be reduced. Such solutions are of relevance also in the context of embedded and embodied AI, i.e. AI capabilities in robotics and connected devices/objects, including small (down to micro/nanoscale) objects with long-term autonomy.

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Optimized AI solutions: optimizing model design and data usage to maximize accuracy and robustness.
* Ensure, in general, the pipeline of high-quality, representative, unbiased and compliant training data for AI development in all relevant sectors
* Support data preparation and AI training processes that lead to efficient and more trustworthy AI

Scope:

Proposals should address novel AI methods and training data provision processes, aiming at high quality and reliable AI while minimizing the data needs and manipulations, targeting smart and dynamic end-to-end automation of AI training in the cloud-edge computing continuum, where AI training, AI deployment and data collection/preparation happens at the most appropriate level of the cloud-edge continuum. This will lead to better quality of AI by smart data selection/harvesting/preparation and reduces the need to collect, store, process and transfer large amounts of data and/or large AI models.

Proposals should address exactly one of the following areas:

* automated and AI-based mining, harvesting, selection, cleaning, annotation, and/or enrichment/augmentation of data for AI; generating and using synthetic data to reduce the need for large volumes of real and potentially sensitive data; validating the efficiency of these processes in AI systems;
* lighter, less data-intensive and less energy-consuming AI models, optimized learning processes that require less input (data efficient AI) without degrading the quality of the output; machine learning methods and architectures that deal with lower volumes such as transfer learning; one-shot learning; continuous and/or lifelong learning[[140]](#footnote-141);

At least one proposal will be selected for each of the two areas above. Proposals should clearly mention which of the two areas they address.

The work should contribute to increasing data efficiency and energy efficiency of AI, and rationalize the provision of data for AI. The work should support appropriate AI paradigms (central, distributed, dynamic, hybrid), responding and adapting easily to the needs of the use situation, and to the changing characteristics, availability and use conditions for data.

Target AI systems should be appropriately evaluated and results analysed and fed back to ensure continuous improvement of the “data for AI” pipeline.

Multidisciplinary research activities should address all of the following:

* Proposals should involve appropriate expertise in all the relevant disciplines, such as e.g. engineering, data science, computer sciences, mathematics, and where applicable in Social Sciences and Humanities (SSH).
* Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms, especially the actions funded in the Digital Europe programme, under the chapter “Cloud, data and artificial intelligence”.
* Contribute to making AI, data and robotics solutions meet the requirements of trustworthy AI, based on accuracy, robustness, safety, ethical principles and reliability, in line with the European Approach to AI. Ethics principles needs to be adopted from early stages of development and design.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating concrete potential added value), and share communicable results with the European R&D community, through the AI-on-demand platform, Digital Industrial Platform for Robotics and Common European data spaces, and if necessary other relevant digital resource platforms in order to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

The proposal should describe the characteristics and availability of the data to be used within the project and explain how the possible privacy and IPR issues related to the data are addressed. The provenance, associated metadata and any other contextual information should be collected and maintained to the extent necessary in order to enable validation and support explainable AI and to ensure continuous compliance with applicable legislation (e.g. GDPR, AI act, data act).

This topic implements the co-programmed European Partnership on AI, data and robotics.

**HORIZON-CL4-2023-HUMAN-01-02 Large Scale pilots on trustworthy AI data and robotics addressing key societal challenges (AI Data and Robotics Partnership) (IA)**

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| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 8.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [23-25] million. |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

1. Strengthening EU’s ecosystem of AI, Data and Robotics excellence and innovation in world class foundational and application-inspired and application-oriented research;
2. Technology progress in AI addressing major challenges hampering the deployment of AI, Data and Robotics technologies;
3. Wide uptake of AI, Data and Robotics technologies by industry and end-users towards the Digital Decade targets for 2030.

* Robust and trustworthy AI, Data and Robotics technologies

Scope:

AI is key to maintain European sovereignty in major industrial sectors strategic for Europe. Human-centric approaches are key to acceptance and to ensure safety, security and protection of fundamental right. To assure safety and human acceptance trust is mandatory. AI based solutions and tools can boost societal wellbeing and economic growth. To promote their deployment and uptake, there is a need to test and improve their robustness, performance and reliability in real-world scenarios and on concrete use cases to identify and overcome barriers to their deployment. Large scale pilots involving industry and end users can demonstrate how AI, Data and Robotics enabled solutions can benefit, both industry as well as a society, demonstrating robustness and “trustworthiness” (in all its dimension). Pilots should target technological advances with large scale potential impact ion strategically important sectors with large societal impacts such as healthcare, improved working and/or living conditions, etc.

Multidisciplinary research and innovation activities should address all of the following:

* Proposals should involve appropriate expertise in all the relevant disciplines, such as engineering, computer sciences, mathematics, Social Sciences and Humanities (SSH), biology, etc. and involve the relevant expertise to address the selected application sector.
* Build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.
* Involvement of end-users in the requirement and validation of the pilots to ensure human-centric approach and maximise acceptance.
* Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination.
* Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.
* Contribute to making AI and robotics solutions meet the requirements of Trustworthy AI, based on the respect of the ethical principles, the fundamental rights including critical aspects such as robustness, safety, reliability, in line with the European Approach to AI. Ethics principles needs to be adopted from early stages of development and design.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating concrete potential added value), and share communicable results with the European R&D community, through the AI-on-demand platform or Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

This topic implements the co-programmed European Partnership on AI, data and robotics.

HORIZON-CL4-2023-HUMAN-01-03: Natural Language Understanding and Interaction in Advanced Language Technologies (AI Data and Robotics Partnership) (RIA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [19-21] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exception applies:   * Financial support to third parties. |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 200 000 to support open innovation challenges and drive general progress on important tasks through a common benchmark problem which allows different approaches to be compared. |
| *Procedure* | The procedure is described in General Annex F.  The following exceptions apply:  To ensure a balanced portfolio covering ‘context-aware human-machine interaction’ and ‘seamless human-to-human communication’, grants will be awarded to applications not only in order of ranking but at least also to one project that is the highest ranked within each area, provided that the applications attain all thresholds. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Development of natural language understanding and interaction in advanced language technologies based on context-aware language models able to further integrate long-term general knowledge and derive meaning in order to develop automated reasoning and enhanced interaction skills;
* Effective multilingual and bias-controlled language models, capable of learning from smaller language corpora, efficient in computing and respectful of European values (i.e., privacy, non-discrimination, robustness in legal, ethical and technical terms, reliability and trustworthiness, interpretability and explainability, security and safety);
* AI systems and solutions based on novel multilingual pre-trained language models that have assimilated cross-language and cross-cultural knowledge through textual and speech input;
* Higher uptake of innovative language technology solutions by European companies, providing extensive language coverage[[141]](#footnote-142) of AI-enabled applications and services in Europe.

Scope:

As AI becomes increasingly more performant, there is growing potential for humans to directly use and benefit from smarter systems. Effective AI-based human-machine interaction and collaboration relies on grasping real meaning from natural languages, recognising gestures and activities, understanding intention, creating and maintaining shared mental models and designing multi-step interactions. Reciprocally, truly natural interaction between people and machines is essential for future AI-enabled systems across all application areas and domains.

Envisaged AI solutions should address one or both of the following areas:

* Improve **context-aware human-machine interaction** to increase under­standing and exploitation of the interaction context and content in multimodal settings, thus increasing responsiveness of interactive AI solutions, such as smart assistants, conversational and dialogue systems, etc.
* Support and enhance **seamless human-to-human communication** across languages e.g. by means of automatic translation or interpretation (incl. automatic subtitling) in real time with a greater understanding of the communication context and the meaning involved in it.

At least one proposal will be selected per area.

Multidisciplinary research activities should address at least one of the following:

* Developing novel methods and techniques for producing **context-aware models**, which incorporatestructured and unstructured knowledge in broader situational and temporal information, and continual learning to achieve natural behaviour in all intended settings.
* Improving large **pre-trained** **multilingual language models** to cover a large set of languages[[142]](#footnote-143), with a high level of natural language understanding and the ability to efficiently add more languages, including low-resource ones, via transfer or language-independent learning methods.
* Improving language-independent and bias-controlling **algorithms and methods for language model** **training and usage efficiency** in terms of data, time and energy consumption while retaining performance, accuracy and general usability.
* Developing **language representations**, encompassing an effective combination of multilingual, symbolic and sub-symbolic knowledge and allowing systems to perform cross-cultural reasoning in various contextual tasks.

Proposals should involve appropriate expertise in all the relevant disciplines, such as data science, computer science, machine learning, natural language processing and SSH.

Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating concrete potential added value), and share communicable results with the European R&D community, through the AI-on-demand platform, Common European data spaces (especially the dedicated Language Data Space) and other relevant Member States initiatives such as Open GPT-X, and if necessary other relevant digital resource platforms in order to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

This topic implements the co-programmed European Partnership on AI, data and robotics.

HORIZON-CL4-2023-HUMAN-01-04: Open innovation: competitions addressing Grand challenges in AI (AI Data and Robotics Partnership) (CSA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 4 million. |
| *Type of Action* | Coordination and Support Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exception applies:   * Financial support to third parties. |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 500.000 to address open innovation challenges on key important S&T challenges and drive general progress on important tasks through a common challenge/benchmark problem. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Drive substantial scientific progress in major scientific & technological AI challenges
* Develop prestigious competitions and prize that will mobilise wide participation of top scientists from academia, industry including start-ups and as well as young teams and rising stars from all over EU and Associated countries.
* Substantially increase interest from industry in AI (incl. SMEs and start-ups), in particular from key socio-economic sectors for Europe. Therefore contributing to uptake of research results by industry

Scope:

AI is a general purpose technology that is expected to substantially contribute to all sectors and applications. AI technologies have demonstrated great value and potential in areas as diverse as healthcare, supply chain logistics, space-based imagery analysis, cybersecurity. However, there are challenges that AI technologies are facing. When it comes to deployment of AI technologies, reliable performance is required. Despite its huge potential and its ability to cut down on tasks and costs, AI faces trust issues with humans. At the same time, the failure modes of AI technologies are poorly understood.

Open innovation challenges can foster broad and robust progress on generic AI research challenges. The resulting scientific progress resulting such challenges will contribute to the robustness of AI systems in general, enabling a multitude of different applications across many sectors.

Proposals are expected to organize open innovation challenges aiming to bring the best research teams across variety of public and private organisations that compete to tackle and crack major S&T challenges in AI. The competition will be bootstrapped by engaging EU funded projects to participate[[143]](#footnote-144).

Proposals should address the delivery of challenge-led, AI competitions with the aim to

* Attract outstanding talent and the best research teams to compete in tackling key scientific and technological AI challenges, of relevance to industry.
* Prepare the competitions addressing challenges in line with the projects funded under the following topics: CL4-2023-HUMAN-01-01, CL4-2024-HUMAN-01-01, CL4-2024-HUMAN-01-02 and CL4-2024-HUMAN-01-02 focusing on optimisation, explainability, robustness, natural language understanding and interaction, and collaborative intelligence[[144]](#footnote-145) respectively. The projects funded through these calls will be required to participate in the respective competitions.
* Drive substantial and broad scientific progress in key AI challenges with the aim to reinforce the research excellence in Europe.
* Enable strong cooperation and co-creation between academia and industry and establish a continuous interaction
* Attract industry and business interest in demonstrating advanced performances meeting the needs of user industry, in view of fostering deployment and business opportunities in Europe.
* Define a process that fosters the uptake of developed algorithms/solutions

Proposals are expected to

* Provide a sound methodology for the design of AI challenges as competitions, including the definition of challenges to be addressed, representative of common needs for a vast adoption in a broad set of industrial and public sectors; as well as the definition of evaluation method and criteria. This involves mobilisation of prestigious scientists and industries to select the data/problems that will drive substantial scientific progress and be help reinforcing the reputation of Europe, contributing to build the European AI lighthouse
* Provide a convincing approach to attract the best teams from academia and industry to compete to tackle such important and challenging problems,
* Address all aspects of running competitions and best exploit them to maximise the visibility of AI to the wider audience.
* Mobilise external partners (incl. from industry) in sponsoring and setting up the competitions and engage sponsors to contribute/offer money prizes or other attractive rewards to winners/top ranked candidates (e.g. internships in prestigious labs or companies etc.)
* Collaborate with AI on Demand Platform, the AI, Data and Robotics Partnership, other relevant initiatives, as well as the Networks of AI excellence centres[[145]](#footnote-146) as well as projects funded under CL4-2023-HUMAN-01-01 and CL4-2023-HUMAN-01-03.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring), and share communicable results with the European R&D community, through the AI-on-demand platform, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

Furthermore it is expected that the participating teams will make their algorithms and methods available to ensure scientific and technological progress.

HORIZON-CL4-2024-HUMAN-01-01: Explainable and Robust AI (AI Data and Robotics Partnership) (RIA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 9 and 10 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [28-32] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exception applies:   * Financial support to third parties. |
| International cooperation | In order to achieve the expected outcomes, international cooperation is encouraged, in particular with Canada and India. |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 200 000 to support open innovation challenges and drive general progress on important tasks through a common benchmark problem which allows different approaches to be compared. |
| *Procedure* | The procedure is described in General Annex F. |

Expected Outcome: Projects are expected to contribute to one of the the following outcomes:

1. Enhanced robustness, performance and reliability of AI systems, including awareness of the limits of operational robustness of the system
2. Improved explainability and accountability, transparency and autonomy of AI systems, including awareness of the working conditions of the system

Scope: Trustworthy AI solutions, need to be robust, safe and reliable when operating in real-world conditions, and need to be able to provide adequate, meaningful and complete explanations when relevant, or insights into causality, account for concerns about fairness, be robust when dealing with such issues in real world conditions, while aligned with rights and obligations around the use of AI systems in Europe. Advances across these areas can help create human-centric AI[[146]](#footnote-147), which reflects the needs and values of European citizens and contribute to an effective governance of AI technologies.

To achieve robust and reliable AI, novel approaches are needed to develop methods and solutions that work under other than model-ideal circumstances, while also having an awareness when these conditions break down. To achieve trustworthiness, AI system should be sufficiently transparent and capable of explaining how the system has reached a conclusion in a way that it is meaningful to the user, while also indicating when the limits of operation have been reached.

The purpose is to advance AI-algorithms that can perform safely under a common variety of circumstances, reliably in real-world conditions and predict when these operational circumstances are no longer valid. The research should aim at advancing robustness and explainability for a generality of solutions, while leading to an acceptable loss in accuracy and efficiency, and with known verifiability and reproducibility. The focus is on extending the general applicability of explainability and robustness of AI-systems by foundational AI and machine learning research. To this end, the following methods may be considered but are not necessarily restricted to:

* data-efficient learning, transformers, reinforcement learning, federated and edge-learning, automated machine learning, or any combination thereof for improved robustness and explainability.
* hybrid approaches integrating learning, knowledge and reasoning, model-based approaches, neuromorphic computing, or other nature-inspired approaches and other forms of hybrid combinations which are generically applicable to robustness and explainability.
* continual learning, active learning, long-term learning and how they can help improve robustness and explainability.
* multi-modal learning, natural language processing, speech recognition and text understanding taking multicultural aspects into account for the purpose of increased operational robustness and the capability to explain alternative formulation[[147]](#footnote-148).

Multidisciplinary research activities should address all of the following:

* Proposals should involve appropriate expertise in all the relevant disciplines, and where appropriate Social Sciences and Humanities (SSH), etc.
* Contribute to making AI and robotics solutions meet the requirements of Trustworthy AI, based on the respect of the ethical principles, the fundamental rights including critical aspects such as robustness, safety, reliability, in line with the European Approach to AI. Ethics principles needs to be adopted from early stages of development and design.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring), and share communicable results with the European R&D community, through the AI-on-demand platform or Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

HORIZON-CL4-2024-HUMAN-01-02 Collaborative intelligence – combining the best of machine and human (AI Data and Robotics Partnership) (RIA)

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| **Specific conditions** | | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is EUR [19-21] million. | |
| *Type of Action* | Research and Innovation action | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exception applies:   * Financial support to third parties. | |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 200.000 to address open innovation challenges on key important S&T challenges provided they are generally applicable and drive general progress on important tasks through a common challenge/benchmark problem. | |
| *Procedure* | The procedure is described in General Annex F. | |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* **Advancement of human-machine interaction** - general advancements in human-computer interaction, operational for a broad range of AI-reasoning systems and applicable to a broad range of application areas of AI.
* **Improved human decision-making and analytic abilities -** Demonstrate that collaborative decision-making improves over human decision-making and that the collaborative decisions cover all stages of reasoning (that they are based on an improved coverage of data and knowledge sources, on an improved analytic ability to reason from input to output, and on a well-communicated decision).
* **Demonstrate the value of collaborative decision making** by improved effectiveness, efficiency, completeness, limits of knowledge indication and other objective or quantifiable subjective measures.

Scope:

The R&I priorities require work at different levels, including both foundational research and well-studied piloting efforts, concentrated in impactful projects, bringing critical mass of expertise and investment to demonstrate potential for more than one major application sectors respectively.

Research should focus on:

* foundational research towards the next generation of collaborative AI, bringing excellence, critical mass and novel approaches as well as quantitatively proven improvement in the levels of human-machine collaboration.
* simulations and experimentation (with and without humans in the loop) to explore the consequences of different interventions and/or to explore the design approaches that help manage decision making.
* integrating advances from [effective, efficient, anticipative, multi-modal] human-computer interaction and from [incremental, continually learned, or anticipative], automatic reasoning systems in order to create new generations of collaborative AI-systems that better and more naturally serve human needs. The means of collaboration can cover the whole range of multi-modal stimuli: lingual, image, video, sound and other forms of interaction, whatever is arguably the most appropriate in the interaction process.

Multidisciplinary research activities should address all of the following:

* Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH)
* Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.
* Projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.
* Contribute to making AI and robotics solutions meet the requirements of Trustworthy AI, based on the respect of the ethical principles, the fundamental rights including critical aspects such as robustness, safety, reliability, in line with the European Approach to AI. Ethics principles needs to be adopted from early stages of development and design.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring, as well as illustrative application use-cases demonstrating concrete potential added value), and share communicable results with the European R&D community, through the AI-on-demand platform or Digital Industrial Platform for Robotics, public community resources, to maximise re-use of results, either by developers, or for uptake, and optimise efficiency of funding; enhancing the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

***The ideas of the topic below (HUMAN-01-05) seem to display synergetic potential for joint approaches with Cluster 2 and may possibly be hosted in there.***

***At this stage, the current elements are still presented below for awareness and early feedback but may evolve according to cross-cluster discussions.***

**HORIZON-CL4-2023-HUMAN-01-05 Through AI from Disinformation to Trust (IA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR [4-6] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [8-10] million. |
| *Type of Action* | Innovation Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  To ensure a balanced portfolio covering different types of advanced AI solutions against disinformation, grants will be awarded not only in order of ranking but at least also to the highest ranked proposal addressing each of the two expected outcomes (1. Advanced AI solutions against advanced disinformation techniques for media professionals, and 2. Advanced AI solutions against disinformation for citizens), provided that the applications attain all thresholds. |

Expected Outcome: Proposal results are expected to contribute to one of the following expected outcomes:

1. Innovative AI solutions for trusted information production for media professionals.
2. Innovative AI solutions for supporting trustworthy online activity of citizens.

Scope: Following the results of the first HE work programme, the second work programme will support innovation activities to move closer to AI-based market and ultimately widely available solutions that can play an important role in ensuring pluralistic access to meaningful information, quality content and trustworthy online interaction. This topic is fully in line with both the EDAP – European Democracy Action Plan and MAAP – Media and Audiovisual Action Plan, for reinforcing the European media ecosystem and maintaining resilient democratic systems, in times of crises and of need for adaptation and change.

Given the emergence of the next generation of social media as part of digital universe(s) or fediverse(s), which are more immersive and based on virtual realities and gaming contexts, the detection of different forms of content manipulation (e.g. deep-fakes, tampered content and scammed environments) becomes even more challenging.Solutions provided would include the correlation/comparison of various sources of information, multi-modal language interpretation, rapid visual pattern detection in moving images and simulated environments, capabilities as recommendation engine/personal companion, and interfacing with augmented, virtual reality and gaming environments. The innovation actions will bring together technological providers, media professionals and end users for ensuring market readiness of the results.

Proposals should clearly identify the expected outcome it will focus on (i.e. media professionals or citizens). All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, demonstrators, benchmarking and progress monitoring), and share communicable results with the European R&D community, through the AI-on-demand platform. Activities are expected to achieve TRL6-7 by the end of the project. All proposals are expected to allocate tasks to cohesion activities with the other subtopic, the PPP on AI, Data and Robotics and funded actions related to this partnership, and to extend and apply the results from the previous research and innovation topic on AI against Disinformation.

## **An Internet of Trust**

HORIZON-CL4-2023-HUMAN-01-11: Framework Partnership Agreement (FPA) for the Next Generation Internet commons

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| **Specific conditions** | |
| *Expected EU contribution per project* | Non available |
| *Indicative budget* | Non available |
| *Type of Action* | Framework Partnership Agreement |
| *Technology Readiness Level* | N. A. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcome: The partnership is expected to contribute to the following outcomes:

* An internet aligned with values commonly shared in Europe such as protection of privacy, inclusiveness, transparency, autonomy, openness and cooperation across borders.
* A trustworthy internet centred around humans in control of their internet experience with improved trust, privacy, portability, discoverability, inclusion, and better sharing and search of personal and non-personal data, implementing optimal balance between decentralisation, security and energy efficiency and ensuring more socio-economic benefits.
* A structured and impactful eco-system of talented contributors driving the creation of new internet commons based on open source software, open standards and open hardware and designs.
* A new landscape of European organisations (e.g. foundations) ensuring sustainable growth and maintenance of strategic internet commons.
* A fruitful collaboration with like-minded efforts at European level and globally.

Scope: The general objective is to nurture a structured eco-system mobilising top value-driven open source innovators in Europe enabling to create, mature and grow new internet commons. These commons encompass the whole internet stack from open hardware, networking and transport technologies, firmware, operating systems and virtualisation, electronic identities and middleware, decentralised ledgers, software productivity tools, traffic supervision tools, up to over the top internet and vertical applications.

The proposers should devise a value-by-design plan addressing the following specific objectives:

* To attract top open source innovators by translating the NGI narrative into motivating challenges for value driven people.
* To fund projects contributing to internet commons through financial support to third parties based on excellence, respecting the principles of fairness, transparency, confidentiality and no conflict of interest, while avoiding duplication of efforts by reusing existing commons.
* To mature solutions by e.g. performing security and accessibility audits, providing advices on licensing regime, on deployment and packaging, localising the solution.
* To grow solutions to critical mass by animating actively the community, creating synergies and momentum among like-minded projects, advising on standardisation path and by identifying funding sources.
* To transition to sustainability by providing legal hosting, supporting community management, and advising on governance and funding models.
* To elaborate a strategic and coherent picture of the funding effort identifying maturity levels and pursuing the objective of minimising the deployment effort.
* To ensure transparent governance translating policy input into priorities and striving for European autonomy for internet commons.
* To develop alliances with like-minded efforts in Europe and globally, create synergies with other NGI actions (notably NGI pilots) and promote the results to relevant audiences such as operators, users, policy makers and public at large.

Maximum openness in implementing this policy is required: for that purpose a minimum of 80% of all budget allocated to this action should be used to financially support research and innovation from internet commoners across Europe and selected through open calls outside the FPA consortium.

Proposers should demonstrate their experience and understanding of open source communities and their expertise covering the full open source life cycle through proven track record including years of experience and indication of volume of open source projects supported.

The long-term cooperation between the Commission and the selected partners will be formalised within a Framework Partnership Agreement covering the remaining duration of Horizon Europe. The extended duration of the partnership is justified by the need to cover the full life cycle of open source projects until sustainability.

Through the Framework Partnership Agreement (FPA), the Commission intends to award specific grants to implement the FPA, in accordance with the procedures laid down in the FPA (see also section on "Other actions").

HORIZON-CL4-2023-HUMAN-01-12: Pilots for the Next Generation Internet (IA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR [ 3 - 5 ] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [13-15] million. |
| *Type of Action* | Innovation Action |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Apply Next Generation Internet (NGI) technologies in a variety of industrial and societal use cases, enabling the emergence of internet ecosystems supporting the needs of key vertical sectors with high socio-economic impact.
* Generate new business opportunities and enable the emergence of new business and sustainability models based on Open Source.
* Support the community of European top internet innovators, with the capacity to set the course of the Internet evolution according to a human-centric approach.

Scope:

The aim of this topic is to foster the take up of Next Generation Internet (NGI) technologies and solutions in Europe by integrating them in a variety of industrial and societal use cases, enabling the emergence of internet ecosystems supporting the needs of specific sectors, such as (but not limited to) public services, healthcare and well-being, supply chain management, transport, finance, creative and cultural industries, tourism, energy and ICT sector.

NGI Pilots will make use of the rich portfolio of technologies and tools developed in the NGI programme in Horizon 2020 and Horizon Europe, and will apply them to real-life use cases with the goal of validating NGI human-centric solutions across value chains, as close as possible to operational conditions, engaging large user groups and proving their socio-economic potential. Pilots will also address sustainability beyond the lifecycle of the project.

Pilots will involve user organisations from vertical sectors, NGI innovators and other digital technology providers. Pilot projects will need to carefully consider the needs and expectations of the end-users as main drivers of the technological developments, as well as energy efficiency requirement.

Pilots will include development, integration, testing, deployment, uptake and operation activities. Focus will be on open source solutions (both software and hardware) and their integration and adoption in vertical use cases, to ensure replicability of the results and portability in different areas. Proposals should address use cases from at least two different verticals and address their interdependencies.

Proposals should encourage, when relevant, open access to data, standardisation activities, as well as an IPR regime ensuring lasting impact and reusability of results.

Proposals should incorporate third party contributions from NGI open source innovators. A minimum of 15% of the total requested EU contribution should be allocated to financial support to third parties, selected through open calls.

The Commission considers that proposals with an overall duration of typically 24 to 36 months would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations. For ensuring focused effort, third parties will be funded through projects typically in the EUR 10 000 to 50 000 range per project, with indicative duration of 6 to 9 months.

HORIZON-CL4-2023-HUMAN-01-13: Building strong international partnerships and promoting NGI solutions globally (RIA or CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR xx million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [5-7] million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | N. A. |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Supporting the EU internet policy objectives by sharing the EU vision and values with international partners, and forging bonds through concrete collaborations.
* An international ecosystem of top researchers, open source developers, high-tech startups / SMEs and Internet related communities collaborating on the evolution of the Internet according to a human-centric approach.
* Enhanced EU-US and EU-Canada cooperation in the development of Next Generation Internet technologies, services and standards.
* Generate new business opportunities for European Internet innovators based on decentralised technologies and open source.

Scope:

The international actions will focus on reinforcing the transatlantic partnership with the US and Canada, and promoting NGI solutions globally, with a focus on EU neighbourhood and Africa. These actions will deepen the current R&I collaboration with the US and Canada while extending it to other countries / regions.

The regions that will be finally addressed in this topic, its scope and the implementation details (including the type of instrument: RIA or CSA), are under discussion with our international partners and will be provided in the next versions of the WP.

## **eXtended Reality (XR)**

**HORIZON-CL4-2023-HUMAN-01-21: Next Generation eXtended Reality (RIA)**

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 5 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is EUR [27-29] million. | |
| *Type of Action* | Research and Innovation Action | |
| *Technology Readiness Level* | Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project – see General Annex B. | |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. | |
| *Links* | (other clusters, Cl4 WP21-22, JUs, DEP, other)  HORIZON-CL4-2022-HUMAN-01-14: eXtended Reality Technologies (RIA) |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Next generation of XR devices and applications, by exploiting cross fertilisation between technologies such as 5G/6G, IoT, data, artificial intelligence, edge and cloud computing, and microelectronics but also across domains of use such as (but not limited to education, manufacturing, health, cultural heritage, media and security).
* More realistic and more affordable devices and applications, developed by European companies, respecting European values of ethics, privacy, security and safety, aiming at technological sovereignty and resilience.

Scope:

The following two types of research and innovation proposals are expected:

1. The development and integration of advanced XR hardware components, such as displays, optics and sensors, for a new generation of XR devices providing greater visual, wearable, vestibular and social comfort. Special relevance should be given (a) to technological breakthroughs in photonics and new materials aiming to increase the image quality and to reduce the size and weight of XR devices; (b) to displays and optical elements bringing the capabilities of XR devices closer to those of the human vision; (c) to more efficient architectures for enhanced performance, reduced power consumption and improved heat dissipation; (d) to novel systems that cater to the widest range of users, including those that need prescription correction; (e) to advanced optical- and photo-detector technologies for sensing systems, including sensing data processing; (f) to innovative XR connectivity components supporting the demanding requirements on latency, data rates and resilience; and (g) to novel materials with tailored optical, mechanical and processing properties for a tight integration of subcomponents, enabling overall miniaturization and environmentally sustainable mass-production of future XR devices.

At least one proposal of this type will be funded.

1. The development of new solutions aiming to improve the user experience, skills and capacity in social and professional XR setups. This includes tools and services for the creation and management of interactive virtual worlds and 3D models, realistic full body avatars and intelligent agents. The solutions will also seek to enhance the interoperability, performance and accessibility of XR experiences. The proposals will include prototypes validated in realistic scenarios, proving how innovative the developed solutions are, how they exploit synergies between disciplines and domains, and how far beyond state of the art they go.

At least one proposal of this type will be funded.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities

**HORIZON-CL4-2023-HUMAN-01-22: eXtended Reality for Industry 5.0 (IA)**

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 5 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [24-26] million. |
| *Type of Action* | Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 4 and achieve TRL 7-8 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. The following exceptions apply: |
| *Financial Support to Third Parties* | Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 500 000 to further extend the application domains, guarantee reproducibility and demonstrate the integration paths for take-up by European industries. |
| *Links* | (other clusters, Cl4 WP21-22, JUs, DEP, other)  HORIZON-CL4-2021-HUMAN-01-25: eXtended Collaborative Telepresence (IA) |

Expected Outcome: Projects are expected to contribute to the following outcomes:

* Develop “XR made in Europe”, contributing to technological sovereignty.
* Contribute to develop virtual worlds European platforms.
* Support the use of XR technologies for a sustainable, human-centric and resilient European industry[[148]](#footnote-149).

Scope: The following two types of innovation proposals are expected.

* i. The development of XR applications to support companies in all industrial ecosystems, especially SMEs, to use innovative interactive and immersive technologies, increasing their competitiveness, productivity and efficiency. The applications should be robust, safe and trustworthy, especially in terms of cybersecurity, privacy and health issues. Proposals should exploit cross fertilisation between academics, industry representatives and end-users around well thought-out scenarios. Moreover, proposals should include activities to showcase the results, widely disseminating and exploiting the outcomes.
* ii. The creation of a European reference platform aiming to develop and prototype advanced interoperable XR solutions to solve common challenges encountered by the industry (in areas such as assembly, maintenance, remote operation, training, design, logistics, etc.), placing the wellbeing of workers at the centre of the production process. The platform will be populated with third party-projects exploring a wide range of XR technologies and taking benefit of other emerging technologies (such as 5G/6G, IoT, data, artificial intelligence, edge and cloud computing, and microelectronics). In order to facilitate the integration with existing IT systems and policies, the EU XR platform for industry should prioritize XR content, tools and solutions based on open standards, such as OpenXR and WebXR. The solutions provided by the platform should aim to cover as many industry ecosystems as possible. Involvement of end-users is essential in defining specifications and testing.

At least one proposal will be funded for the innovation type i

Only one proposal will be funded for type ii.

Financial support to third parties

The type ii innovation action will provide financial support third-party projects from outstanding XR innovators, SMEs and other multidisciplinary actors through a minimum of three open calls during the lifetime of the project.

The consortium will define a coherent and coordinated programme logic for the third-party projects, offering the necessary technical support, coaching and mentoring, to ensure a significant advancement and impact in the innovation domain, including in terms of interoperability and standardisation. These tasks cannot be implemented using the budget earmarked for the financial support to third parties.

Proposals should make explicit the intervention logic for the area and their potential to attract relevant top XR talents and to deliver a solid value-added to the third-party projects. Proposals should also prove the expertise and capacity of the consortium in managing the full life-cycle of the open calls transparently and efficiently.

As support and mobilising of XR innovators is key to the type ii IA of this topic, a minimum of 60% of the total requested EU contribution should be allocated to financial support to the third parties.

The Commission considers that proposals with an overall duration of typically 36 months would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations.

For ensuring focused effort, third parties in type ii will be funded through projects typically in the EUR 250 000 to 500 000 range per project, with indicative duration of 12 to 15 months.

This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities

## **Systemic approaches for accelerating uptake of technology and innovation**

HORIZON-CL4-2023-HUMAN-01-31: Toolbox for efficient IP licensing for market uptake and societal value creation (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 2.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2.00 million. |
| *Type of Action* | Coordination and Support Actions |

Expected Outcome: Proposals are expected to contribute to the following outcomes:

* Promote effective use and deployment of intellectual property ensuring easier access to and sharing of IP-protected assets which are essential to the development of digital and industrial solutions among others, benefitting society.
* Provide models to improve the preparedness to respond to future emergencies with adequate solutions (including digital and industrial solutions) via efficient technology licensing.

Scope: Technology transfer, rapid sharing and access to knowledge assets are playing major role in the global Covid-19 response. The uptake of new technology transfer practices, including digital and data-driven, increased role of the various intermediaries and several novel intellectual property (IP) related access initiatives, such as socially responsible and impact licencing models have demonstrated that knowledge and intellectual asset management is a key tool to address the demanding societal needs related to the pandemic.

Robust and resilient R&I leads to scientific progress and enables the ecosystem delivering and adapting solutions for the society and the challenges it faces. IP and use of different types of collaboration contracts, licenses and pooling agreements are key elements of the process by facilitating technology sharing, increasing scaling up and thereby creating new capacities and industries.

In line with the EU IP action plan and the Report on an intellectual property action plan to support EU’s recovery and resilience by the European Parliament[[149]](#footnote-150), this action will promote better IP management in research and innovation in view to materialise excellent research into innovation that is benefitting the society and businesses in the EU and beyond.

This activity will deliver an IP toolbox for helping companies, public research organisations including universities and the relevant intermediary entities to establish quick and efficient co-operation and licences with businesses, as well as practical examples of incentives which can motivate private sector to commit voluntary licensing for other areas e.g. climate change emergency.

This action will harvest the lessons learned as well as practical experiences, including results from FP7 and H2020, and assess how these new practices and tools could be transferred to other emergencies e.g. addressing climate change effects (floods, droughts, fires etc)..) and helping the society to increase preparedness for any future emergencies.

HORIZON-CL4-2023-HUMAN-01-32: Piloting communities of expert facilitators to improve industry-academia-public sector co-creation (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 2.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2.00 million. |
| *Type of Action* | Coordination and Support Actions |

Expected Outcome: Proposals are expected to contribute to the following outcomes:

* Strengthen the base for industry-academia collaboration in the higher education institutions in Europe and help fostering skills addressing industry and public sector needs.
* Facilitate industry and SMEs to capitalise on the diversity of R&I talents, skills and cultures across Europe and spread novel approaches for industry-academia-public sector co-creation in cross-border manner.
* Boosting valorisation of excellent research results and innovation, i.e. transforming them into sustainable solutions with economic and social value across the Union.

Scope: There is a clear need to improve industry-academia interactions in Europe[[150]](#footnote-151) and enhance knowledge valorisation[[151]](#footnote-152) in innovation ecosystems. The role of intermediaries, e.g. industry clusters, science and innovation parks which can provide a collaboration platform and facilitate co-creation is relevant in this context. Methodologies for improved industry-academia co-creation through expert facilitation offer possibilities for higher education institutions to better meet the needs for innovation from the industry, business side and public sector. The diverse pool of R&I talents at the higher education institutions across Europe constitutes a vast source for creativity which should be fully capitalised for innovation.[[152]](#footnote-153)

This action will pilot communities of expert facilitators for increasing knowledge exchange and co-creation between industry, academia and public sector and help matching the supply and demand for innovation. This action will link professionals in industry-academia-public sector collaboration, build communities of expert facilitators for industry-academia co-creation and disseminate best practices and know-how for demand-driven industry-academia collaboration across Europe. This will include training a wider community of expert facilitators in higher education institutions across Europe. This action could also explore complementarities with already existing instruments in the field of university-business cooperation, such as the EIT Knowledge Innovation Communities, EIT HEI Initiative or Erasmus+ Knowledge Alliances.

HORIZON-CL4-2023-HUMAN-01-33: Fostering knowledge valorisation through societal and cultural interactions (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 1.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 5.00 million. |

Expected Outcomes:

Projects are expected to contribute to the following outcomes:

* Value creation and transfer to economy and society by increased interactions between arts and cultural institutions, citizens and industry
* Innovative solutions with strong societal acceptance for uptake and transformative capacity through new conceptualisations of societal challenges enabled through artistic methodologies and approaches
* Enabling interactions, schemes and modes engaging civil society, arts, cultural institutions and industry to benefit communities and promote preparedness, recovery and the twin transition

Scope: The new Industrial Strategy targets place-based innovation with broad stakeholder engagement. The European knowledge valorisation policy places much attention on a more diverse societal engagement involving a multitude of actors in order to create value through innovation benefiting all of society.

Enabling systemic change and achieving the twin transition cannot be achieved by technological solutions alone, if these solutions are not accepted and fully used by society. Engagement with the arts and cultural institutions can increase citizens’ understanding of complex issues (such as climate change, crisis management, data, artificial intelligence etc) and involve citizens in co-creation for solutions drawing on existing knowledge and research results and driven by art and technology. Strengthening approaches of experimentation and creativity common in the ways artistic and cultural interactions operate, in co-creation with citizens and industry, can increase the potential for transformation towards a more prosperous, inclusive and innovative future.

This action aims to strengthen and further develop existing or new schemes promoting arts-industrial technologies-citizens interactions, that increase uptake of new technologies and innovative solutions through better societal understanding and acceptance, as well as co-creation delivering economic and societal benefits. While arts and technology are the main drivers, citizens and communities are empowered to develop, test, co-create and share the benefits of new innovative solutions that address their needs. Industry is stimulated to adopt more human-centred and creative approaches, enhanced by interactions with citizens, artists, designers, cultural and creative professionals and institutions.

The proposals will address at least one of the following challenges:

* Developing and testing new schemes, initiatives and modes for arts-industrial technologies-citizens interactions leading to increased uptake of research results and innovative solutions by market and society. At least 20 new schemes and initiatives across Europe will be tested;
* Transferring, with the appropriate adaptations, and testing in another environment, existing schemes, initiatives and modes for arts-industrial technologies-citizens interactions that increase uptake of research results and innovative solutions by market and society. At least 20 existing (or recent) schemes and initiatives will be tested in a different member state to where they are in place/ originate, across Europe.

HORIZON-CL4-2024-HUMAN-01-34: Support for transnational activities of National Contact Points in the thematic areas of Digital, Industry and Space (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR x million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 5.00 million. |
| *Type of Action* | Coordination and Support Actions |

[The approach and budget for this support will be implemented through the 2024 amendment, once information is available from the three NCP networks of Cluster 4 which will be launched in June 2022.]

## **Research and Innovation for Industry 5.0**

**HORIZON-CL4-2023-HUMAN-01-51: Pilots for an innovative human-centric industry[[153]](#footnote-154) (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 10 million. |
| *Type of Action* | Research and Innovation Action |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6-7, or start at TRL6 and achieve TRL 7, by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Procedure* | The procedure is described in General Annex F. The following exceptions apply:  To ensure the coverage of a broad and diversified portfolio of pilots for an innovative human-centric industry, grants will be awarded, firstly, to the application that is ranked highest on the basis of the award criteria of General Annex D and, secondly, to the application that is the highest ranked among the other applications, taking into account the complementarity of its proposed pilots with those of the afore mentioned application in addition to the award criteria of General Annex D, provided that the applications attain all thresholds. |

**Links with topics in other WPs** (other clusters, Cl4 WP21-22, JUs, DEP, other**)**

Project proposers should consider and actively seek synergies with relevant active and finalised projects/activities in Horizon 2020 and Horizon Europe[[154]](#footnote-155) (both including their public-private and public-public partnerships and EIT KICs) and the Digital Europe programme, as well as within relevant sectorial associations[[155]](#footnote-156)

Expected Outcome:

Project results are expected to contribute to the following outcomes:

* Improved understanding of the socio-technical and ethical implications of advanced (digital) technologies for workers and work organisation across industrial sectors;
* Work environments and work models that make best use of the possibilities of advanced (digital) technologies and the human capabilities and creative potential in a synergistic manner, thus contributing to enhanced European industrial competitiveness in existing and new markets;
* A skilled and creative industry workforce that is empowered through and in control of advanced technologies that are aligned with European social and ethical values.

Scope:

Digitalisation and automation in industry to date have focussed primarily on capitalising on opportunities to increase efficiency and enhance productivity, often without much attention to the changing role of the worker. In its Industry 5.0 concept, the Commission puts forward a view of a resilient, sustainable and human-centric industry. The human-centric approach implies placing core human needs and interests at the heart of processes in industry, rather than taking the technology and its potential for increasing efficiency as a starting point.

A human-centric industry recognises and leverages the capabilities and creative potential of its workers through the synergistic combination with advanced (digital) technologies. In this process, with regard to work organisation, work place design, work content and skills, working conditions and work relations, fundamental principles and human needs such as human autonomy and control, coherence and variation of tasks, work-life balance, social dialogue and others, must be safeguarded, as well as human rights [[156]](#footnote-157) such as privacy and safety. Moreover, as diverse groups of workers experience the increasing impact – as well as opportunities - of the digital transition, upskilling or reskilling is required to meet the digital transformation challenges of the enterprise.

The projects will develop and demonstrate the concept of human-centricity in a real-life, operational industrial environment in at least five pilots each, in different industrial sectors in different EU Member States or countries associated to the Horizon Europe programme. This will require innovating and going beyond-the-state-of-the-art with respect to technology and/or its purposeful application, achieving a Technology Readiness Level (TRL) of at least 7.6 or 7. With regard to digital solutions, the aspect of cyber-security must be adequately addressed in design, implementation and governance. In addition and as appropriate, innovation is expected with respect to work organisation, tasks and functions of workers, skills and training, occupational health and safety, enterprise management and governance (incl. the management of human resources), business models, corporate values and ethics, etc.

In addition, the pilots may address particular themes such as the ones listed hereunder in a non-prescriptive and non-exhaustive manner: the development of and experimentation with models and technologies to stimulate individual and collective creativity of workers, the participation of workers (as end-users) in the design of purposeful technology application in the work process, the application of technology to enhance the inclusivity of the work environment, the ways in which unskilled or low-skilled labour participate in a human-centric production process and the role of technology therein, etc.how technological, process and organisational innovation can offer jobs that remain rewarding for the individual worker along the life cycle, the response to the COVID-19 pandemic in terms of the organisation of work and its effects, etc.

The projects will report the obtained results and the practices leading to success, as well as the encountered difficulties and bottlenecks and any trade-off that had to be made. They will identify and analyse direct and indirect effects and outcomes of the pilots, including . These include those that pertain to workers’ satisfaction and well-being, including the acceptance of and relation with technology, as well as those that implicate the competitiveness and resilience of the company and, taking a wider perspective, the societal role of industry as responsible provider of prosperity. The consortia will interpret their findings in a coherent theoretical framework, taking into account the specificities of the setting and context of the pilots. They will formulate evidence-based recommendations tailored to relevant stakeholders, including, as appropriate, policy makers at relevant levels (EU, national/regional, sectoral), social partners, industry federations and professional associations and organised civil society (NGOs).

This topic requires an interdisciplinary approach with the effective contribution of SSH disciplines and the involvement of SSH experts and/or institutions.

The proposals will devote attention to the gender dimension in the content of the proposed research and innovation, in order to deliver scientific quality and societal relevance of the produced knowledge and innovation.

Project proposers should consider and actively seek synergies with relevant active and finalised projects/activities in Horizon 2020 and Horizon Europe and[[157]](#footnote-158) (both including their public-private and public-public partnerships and EIT KICs) and the Digital Europe programme, as well as within relevant sectorial associations[[158]](#footnote-159).

**HORIZON-CL4-2023-HUMAN-01-52: Drivers and success factors for progress towards Industry[[159]](#footnote-160) 5.0 (RIA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR 2 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2 million. |
| *Type of Action* | Research and Innovation Action |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  The following exception applies: the duration of the project will not exceed 24 months. |

**Links with topics in other WPs** (other clusters, Cl4 WP21-22, JUs, DEP, other**)**

Project proposers should consider and actively seek synergies with relevant active and finalised projects/activities in Horizon 2020 and Horizon Europe[[160]](#footnote-161) (both including their public-private and public-public partnerships and EIT KICs) and the Digital Europe programme, as well as within relevant sectorial associations[[161]](#footnote-162)

Expected Outcome:

Project results are expected to contribute to the following outcomes:

* Increased uptake of the Industry 5.0 principles and practices across industrial sectors, achieved through improved understanding of its benefits for enterprises and society and actionable knowledge about factors of success and impediment;
* Sound data and analysis of the uptake of Industry 5.0 in its different dimensions for policy makers at EU, national/regional and sectoral level.

Scope:

In January 2021, the Commission articulated, under the name Industry 5.0 [[162]](#footnote-163), a vision of a future-proof industry that, capitalising on technological progress beyond productivity and efficiency, is the resilient provider of prosperity, within planetary boundaries and placing the wellbeing of the worker at the centre.

In order to optimise policies that stimulate the uptake of the Industry 5.0 principles of sustainability, resilience and human-centricity and facilitate their implementation, an increased understanding of drivers and factors contributing to or hindering successful implementation is required, based on a sociotechnical and multidisciplinary approach, taking technological, social and human aspects into consideration.

The action will select and thoroughly study the successful or less successful implementation of the Industry 5.0 principles in at least five cases in different EU Member States or countries associated to the Horizon Europe programme. This may be complemented with other cases. If a case in a country outside the EU or in a country not associated to the Horizon Europe programme would be proposed, its relevance must be demonstrated in the proposal. The overall design of the study must be well deliberated, founded in a coherent theoretical framework, and provide for a careful selection of cases (for instance, by variation of relevant case characteristics such as company size, industrial sector, country typology, etc.) and for a framework of analysis that can be applied consistently across cases. The smart study design should enable the consortium to extract maximal and relevant insights from the combined analysis of the selected cases.

Taking into account and exploiting the specificities of the cases, the deep analysis of the individual cases, together with the combined analysis of the cases, will address the following research themes in an evidence-based manner.

* **Implementation practices**: How do companies, local innovation ecosystems or industry sectors implement Industry 5.0 principles in practice? Which modes of implementation exist? How does industry go beyond the state-of-the-art and innovate, for instance with respect to (the purposeful application of) technology, work organisation and production, organisation and operation of supply chains, worker tasks and functions, training and skills, human resources management, business models and value chains, corporate governance, partnerships and networks, etc.?
* **Drivers**: What are the drivers for companies, industry sectors or industrial ecosystems to adapt (or not) Industry 5.0 principles? Which trade-offs may have to be made? Which role do public policies and regulatory environment play? How does successful implementation of Industry 5.0 principles provide advantage on multiple dimensions such as competitiveness, reputation, attractiveness for talent, enhanced generation of qualified jobs, adaptive capacity to incremental changes and sudden disruptions, etc.?
* **Success factors and bottlenecks**: What are the factors, either internal or external to the company, that contribute or hinder the uptake and implementation of Industry 5.0 principles? How do workers accept and relate to advanced technology in the work place? What is the role of the embedding of a company in the local community?
* **SMEs**: How can/do SMEs take up Industry 5.0 principles and what is the role of the local innovation ecosystem in this? How does it help SME’s to participate successfully in the green and digital transition of industry?

Proposers are encouraged to elaborate the above research themes further with a view to contributing fully to the expected outcomes. Proposers will explain and motivate the trade-off made between number and representativity of study cases and breadth and depth of analysis.

The analysis must go beyond mere desk research and must be developed and validated in interaction with the actors involved in the respective cases.

Projects will transfer knowledge in actionable form to relevant actors including policy makers, social partners and industry federations, organised civil society (NGOs).

In addition, the action will develop, test and validate a methodology that measures (quantitatively) and evaluates (qualitatively) the progress towards Industry 5.0 in its three dimensions of resilience, sustainability and human-centricity and develop indicator sets that are applicable respectively at the scale of an industrial sector and across sectors, allowing monitoring at relevant levels (EU, national/regional, sectoral).

This topic requires an interdisciplinary approach with the effective contribution of SSH disciplines and the involvement of SSH experts and/or institutions.

Project proposers should consider and actively seek synergies with relevant active and finalised projects/activities in Horizon 2020 and Horizon Europe[[163]](#footnote-164) (both including their public-private and public-public partnerships and EIT KICs) and the Digital Europe programme, as well as within relevant sectorial associations[[164]](#footnote-165).

Project proposers should consider and actively seek synergies with relevant active and finalised projects in the Horizon 2020, Horizon Europe and Digital Europe programmes.

**HORIZON-CL4-2024-HUMAN-01-53: Localised and Urban Manufacturing, supporting creativity (RIA using FSTP)**

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| Specific conditions | |
| Expected EU contribution per project | The Commission estimates that an EU contribution of between EUR 2 and 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| Indicative budget | The total indicative budget for the topic is EUR 12 million. |
| Type of Action | Research and Innovation Action |
| Technology Readiness Level | Activities are expected to start at TRL 5 and achieve TRL 6 by the end of the project – see General Annex B. |
| Legal and financial set-up of the Grant Agreements | The rules are described in General Annex G.  Financial Support to Third Parties. |

Expected outcomes: Manufacturing industry, as well as customers, consumers and wider communities, should benefit from the following outcomes:

1. Designing and demonstrating symbiotic and sustainable factories that support a decentralised manufacturing vision close to the customer – this will in turn bring benefits in terms of flexibility, resilience, urban transformation and minimisation of transport costs and impacts;
2. Developing regenerative concepts that offer increased value for the larger community, inspired by the New European Bauhaus[[165]](#footnote-166);
3. Human-centric approaches to enhance wider engagement and creativity, [and promoting the concept of digital humanism, ]with appropriate contributions from Social Sciences and Humanities (SSH);
4. Improved access to flexible production capabilities in decentralised environments, especially for SMEs.

Scope:

Decentralised, local and urban manufacturing is characterised by small, versatile factories, close to customers, and to highly qualified workers, where various types of customised products are produced in small series for the cost price of mass-produced products.

New technologies offer the possibility of implementing manufacturing processes in localised and urban settings, limiting time to reach the job place for workers, bringing production closer to, and responding to the needs of, customers and consumers, and promoting urban resilience.

Research activities should cover:

* Green and digital technologies that allow production in local and urban contexts with low environmental impact, noise, waste, energy and space consumption.
* Approaches for the circular economy by closing the material and energy cycles in cities and transforming waste streams into productive resources.
* Activities for developing skills and creativity, participatory design strategies, possibly including unemployed workforce, and engaging citizens. The social manufacturing concept may be considered as a way towards more open approaches encompassing Do-it-yourself (DIY), Do-it-together (DIT) and participatory design strategies.

Digitally-enabled solutions that support the local and urban manufacturing vision. Possible technology development includes the adoption of artificial intelligence and smart data approaches to control and optimise distributed manufacturing and logistic processes; Internet of Things solutions and big data analysis to reach zero-defect manufacturing processes and zero-surprises predictive maintenance; distributed ledger technologies to reduce transaction costs.

Developed technologies should be demonstrated in at least two complementary use cases. To achieve this, project consortia may provide financial support to SMEs in the form of ‘Third-party financing’. The maximum amount to be granted to each third party is EUR 100 000.

A human-centric approach should be integrated, with appropriate contributions from Social Sciences and Humanities (SSH); as part of this, a strategy for skills development should be included, associating social partners where relevant.

All projects should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.Proposers are encouraged to consult the results of the Cities of Making project under the JPI Urban Europe.[[166]](#footnote-167)

This topic supports Industry 5.0 goals and complements the co-programmed European Partnership Made in Europe, building on its developments, notably the topic CL4-2023-TWIN-TRANSITION-01-03: Manufacturing as a Service: Mass customised production and services on demand, addressing customer needs and decentralisation.

## **European standards for industrial competitiveness**

HORIZON-CL4-2024-HUMAN-01-61: Facilitate the engagement in global ICT standardisation development (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of up to x million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 6 million. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G.  Minimum 70% of the action goes to Financial support to third parties (FSTP) . |
| *Lump-sums* | YES |
| *Financial Support to Third Parties* | *Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted cumulative to each third party cannot exceed EUR 50 000.* |
| *Procedure* | The procedure is described in General Annex F. |
| *International cooperation* | In order to achieve the expected outcomes, international cooperation is strongly encouraged |
| *Links with topics in other WPs (other clusters, Cl4 WP21-22, JUs, DEP, other)* | Continuation of HORIZON-CL4-2022-RESILIENCE-01-21 and complementary with HORIZON-CL4-2023-HUMAN-01-63 and 64 |

Expected Outcome: Share information about global sectorial ICT standardisation ecosystems and engagement of European stakeholders in global standardisation settings.

Projects are expected to contribute to the following outcomes:

* Set-up of a facility to support participation of European specialists in international ICT Standard Developing Organisations (SDOs) and global fora and consortia, which should increase the influence of Europe into ICT standardisation, including representation in leadership and key positions, to promote incorporation of European requirements, values and interests in ICT standardisation;
* Develop and update sectorial ICT standardisation landscape and gap analysis of ICT standardisation needs in support of EU policies as outlined in the Rolling Plan for ICT standardisation;
* Cooperate, synchronise and achieve capacity building with other similar initiatives or European players including from EU (and national) funded R&I projects; provide a forum for foresight analysis in different sectors;
* Increase awareness on ICT standardisation development;
* Financially support standardisation meetings in Europe of international SDOs and global fora and consortia, so that European players have easier conditions for participation.

Scope: This action will contribute to the objectives spelled out in the EU Standardisation Strategy[[167]](#footnote-168), in particular to **supporting the EU’s leading position in global standards-setting as a forerunner in key technologies and promoting EU core values,** by supporting and empowering the participation of European stakeholders in the development of open technical specifications and standards with the aim to strengthen European competitiveness and sovereignty, promoting European values and ethics, and strengthen the take-up, scalability and cross-sector interoperability of their technological solutions.

The aim is to reinforce the presence of EU and associated states experts in the global ICT standardisation scene, by setting up an ICT standardisation observatory and a facility supporting the participation of key European specialists (especially from SMEs and Academia) in key international and global Standard Developing Organisations[[168]](#footnote-169).

The action will also contribute to the objective of promoting EU cutting-edge innovation that fosters timely standards, by coordinating with other EU funded projects and action that may contribute with their results to ICT standardisation, as well as with EU supported PPPs and Joint Undertakings, seeking for synergies.

To achieve these objectives, key tasks to be carried out are:

* Landscape and gap analysis of international ICT standardisation, including identification of sectors and areas, in particular within the field of internet standardisation, quantum network, IoT, 6G mobile communication, data, edge computing, artificial intelligence, eGovernment, block chain / DLT, cyber security, smart cities & communities, data centres, trusted chips, robotics, circular economy certification etc.
* Setting up of a management facility to support contributions and leadership (e.g. chairing of technical committees, convenor positions) of European specialists (incl. from SMEs and academia) in global ICT SDOs, fora and consortia. Financial support for these specialists will be typically in the order of EUR 1.000 – 10.000 per action by use financial support to third parties (FSTP). 70% of the call budget is expected to be dedicated to FSTP and the maximum cumulated amount of FSTP is EUR 50.000 per third party for the entire duration of the action.
* The consortium will define the process of selection of experts through open calls. It will also define the process that will lead to a selection of a pool of evaluators that will evaluate the applications received in the open calls through the use of FSTP.
* When relevant, support financially the hosting standardisation meetings and workshops in Europe to ease the participation of European experts;
* Facilitate a foresight Committee, which liaise with relevant on-going developments in EU and national funded R&I projects, in particular with projects having identified standardisation outputs or with potential relevant results to contribute to standardisation, including as well other coordination and support actions, and relevant European Partnerships;
* Promotion of the relevance and benefits of ICT standardisation, especially for European industry competitiveness, driving sustainability, sovereignty, green deal, values and ethics. The proposal will also include actions, including development of tools and materials, to promote education on ICT standardisation;
* The proposal should take into account the previous activities carried out the observatory and facilities for funding experts within the topics ICT-40-2017 implemented by the StandICT.eu project and ICT-45-2020 implemented under StandICT.eu2023 project (see [http://www.standict.eu](http://www.standict.eu/)).

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement

Cross-cutting Priorities:[Societal Engagement](https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-search;statusCodes=31094501,31094502,31094503;programCcm2Id=43108390;crossCuttingPriorityCode=SocietalEngagement;sortQuery=sortStatus;orderBy=asc), [Innovation Procurement](https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-search;statusCodes=31094501,31094502,31094503;programCcm2Id=43108390;crossCuttingPriorityCode=InnovationProcurement;sortQuery=sortStatus;orderBy=asc)

**HORIZON-CL4-2023-HUMAN-01-62: Boosting industrial symbiosis by standardisation (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of around EUR 2.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 2.00 million. |
| *Type of Action* | Coordination and Support Actions |
| *Key Policy Trackers* | 1 - Climate Action 40%  2 – Digital 0%  3 – Biodiversity 0% |

Expected Outcome: Proposals are expected to contribute to the following outcomes:

1. Reinforcing the links between standardisation and research and innovation in circular value chains, ensuring that standardisation facilitates cross-sector interoperability at all levels.
2. Facilitating the market entry of innovative solutions, which could aid the circularity of resources and zero pollution.
3. Identifying the major bottlenecks for standardisation related framework conditions to support industrial symbiosis.
4. Helping in the development of agile standards to ensure interoperability in the domain of industrial symbiosis.

Scope: As emphasised in the European Green Deal and in the New Industrial Strategy for Europe, developing new standards, coupled with increased EU participation in international standardisation bodies, will be essential to boost industry’s competitiveness and build a sustainable and more inclusive future.

This action will identify solutions on how standardisation can allow stakeholders at all levels develop a shared understanding of processes by which waste or by‐products of an industry or industrial process become the raw materials for another.

The action will cover manufacturing in a wider context taking into consideration waste treatment and management, energy use and materials sourcing. It will evaluate the impact of industrial symbiosis on the environment and strengthen the link between environmental science and policymaking. In this multidisciplinary approach standards have a key role as they reduce the multiplicity of approaches, terminologies, measurements allowing for accurate benchmarking and target setting.

The selected project may benefit from being addressed by a consortium that includes a variety of stakeholders covering, inter alia, industry, energy, environment and SSH.

**HORIZON-CL4-2023-HUMAN-01-63: Provide for a strong and sustainable pool of experts for European Standardisation: attract the students of university/HEI**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 2, 5 and 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 3 million. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | **YES** |
| *Procedure* | The procedure is described in General Annex F. |

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| **International cooperation**  In order to achieve the expected outcomes, international cooperation is encouraged |

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| **Gender Dimension**  In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement. |

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| **Social Sciences and Humanities (SSH)**  Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in sociology, political science, economy and philosophy, to achieve an academic teaching that covers the different types of impact of standardization including the human-centred approach and compliance with the European core values. |

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**Links with topics in other WPs** (other clusters, Cl4 WP21-22, JUs, DEP, other**)**

***Not applicable***

Expected Outcome: Inclusion of standardization knowledge in curricula of university/Higher Education Institutions (HEI) to educate students about standardisation in order to attract them, a tomorrow’s professionals, to contribute to standardization: *building up a strong and sustainable pool of European standardisation-competent professionals ready to engage in European and International Standardisation.*

Projects should support to the following outcomes

* Increased visibility of standardisation in European universities/HEI;
* More standardisation-competent university/HEI education leavers forming the pool of professionals ready to contribute to and defending EU’s interest in standardisation;
* More set of courses for universities/HEI integrating standardisation contents and covering the respective technological, innovations-supportive and societal aspects including the potential of standards to safeguard EU core values.
* Increased visibility of standardisation at universities/HEI through “Academic Standardisation Days” and setting-up of a Students’ Standardisation Association

Scope: “European Green Deal” and “New Industrial Strategy for Europe” and the geopolitical environment call for a strong EU presence in international standardisation development.

This action aims at providing for a robust and sustainable pool of European professionals ready to contribute to standardisation and support positioning EU as global standard-setter. University/HEI teaching is key to build up the pool of standardisation experts. Academics teaching can provide for standardisation-competent graduates, who are aware of the benefits of standardisation and thus ready, as young professionals, to make Europe’s voice heard in international standardisation.

Those teachers of EU universities/HEI, who already integrate standardisation-related content in their lectures, should team up and, in co-operation with industry, design an innovative teaching concept of standardisation. This concept should cover the standardisation under IEC-, ISO- and ITU-lead, update students on the highly decentralised, global ICT-related standardisation (fora and consortia) and address the technical and societal facets of standardisation (multidisciplinary orientation). The teaching concept has the mission to bridge between these two standardisation domains as well as integrate the aspects of a human-centric standardisation and the EU core values. This concept should foster the development of green and digital skills and underline the respective support through standardisation.

Based on this concept, content modules should be developed for direct and distant teaching. Both, the teaching concept and the modules should be shared with universities/HEI which are ready to include, for the *first time*, standardisation-content in their teaching offer.

Promotion actions should be designed in order to increase the visibility of standardisation in EU academia/HEI; here “Academic Standardisation Days” and “Students’ Standardisation Association(s)” should be considered as practical realisations.

**HORIZON-CL4-2023-HUMAN-01-64: Pre-normative research and standardisation in industrial ecosystems (CSA)**

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR 0.5 and 1.0 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 10.0 million. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Lump-sums* | **NO** |

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| **International cooperation**  In order to achieve the expected outcomes, international cooperation is strongly encouraged. |

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**Links with topics in other WPs** (other clusters, Cl4 WP21-22, JUs, DEP, other**)**

N/A

Expected Outcome:

The action is expected to contribute to the following outcomes within and across the EU industrial ecosystems:

* Contribute to the achievement of the European industrial policy objectives, especially in relation to the green and digital transitions (twin transitions) and the circular economy.
* Bring together the research world (projects, universities, innovation centres, etc.) with supply chains and stakeholders within industrial ecosystems to define standardisation needs and priorities, the role to be played by pre-normative research, and the contributions to be provided at the European and international standardisation level.
* Define roadmaps for pre-standardisation activities in emerging domains not yet covered by ongoing work.
* Establish a platform for the deployment of education and training in standardisation in the framework of the identified industrial sectors.

Scope:

The first [Annual Single Market Report](https://ec.europa.eu/info/sites/default/files/swd-annual-single-market-report-2021_en.pdf) [SWD(2021) 351 of 5/5/2021] identifies the following industrial ecosystems: 1. Aerospace & Defence, 2. Agri-food, 3. Construction, 4. Cultural and Creative Industries, 5. Digital, 6. Electronics, 7. Energy Intensive Industries, 8. Energy-Renewables, 9. Health, 10. Mobility-Transport-Automotive, 11. Proximity, Social Economy and Civil Security, 12. Retail, 13. Textiles, 14. Tourism. Further ecosystems or cross-cutting themes (such as chemicals and materials) may be identified and their delineation adapted based on stakeholders dialogues and changing realities.

The Report analyses their different needs and challenges. In particular, the Report assesses the relevance of standardisation in each ecosystem and proposes specific actions to overcome existing barriers in the Single Market.

The action should cover the coordination/execution of pre-normative research activities in the various ecosystems with a view to exploit synergies among the stakeholders. The scope is to boost the interactions between research projects and pre-normative work in the various ecosystems, and to increase the European contribution and presence in the subsequent formal European and international standardisation processes in line with the objectives of the standardisation strategy that was published by the Commission on 2 February 2022 [COM(2022) 31 final]. Within the standardisation processes particular attention should be dedicated on establishing interoperability standards for data sharing within and across the ecosystems, through the implementation of the FAIR data principles[[169]](#footnote-170) and leveraging on already adopted practices especially those in the relevant European common data spaces and in the European Research infrastructures.

Additionally, a strategy for education and skills development within the ecosystems should be developed, associating social partners when relevant.

The action should build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. International cooperation is encouraged, especially with the international standardisation organisations ISO, IEC and ITU, and similar organisations such as OECD.

HORIZON-CL4-2023-HUMAN-01-65: Support facility for digital standardisation in digital partnership with like-minded countries (CSA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of 1.5 EUR million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 1,5 million. |
| *Type of Action* | Coordination and Support Actions |
| *Technology Readiness Level* | Activities are expected to start at TRL 3-7 and achieve TRL 5-9 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
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| *Financial Support to Third Parties* | *Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted cumulative to each third party cannot exceed EUR 50 000.* |
| *Procedure* | The procedure is described in General Annex F. |
| *Links* | Complementary with HORIZON-CL4-2023-HUMAN-01-61 and HORIZON-CL4-2023-HUMAN-01-66 |

Expected Outcome: further alignment with like-minded countries on a **common vision on ICT standardisation of key technologies** and developing a robust coordination mechanism to express this common vision in international fora/SDOs.

The countries targeted in this action include Japan, South Korea, Taiwan, Singapore, and possibly Canada, Australia, and USA.

Scope: This action will contribute to the EU Standardisation Strategy, particularly in **supporting the EU’s leading position in global standards-setting as a forerunner in key technologies and promoting EU core values,** by:

1. Working together towards defining a **common vision and agenda** for key digital technologies as regards their standardisation aspects, timelines etc. The aim is to engage and work towards a common position with like-minded countries in ICT standardisation of key technologies prioritised in Horizon Europe, such as AI, 5G and beyond, internet protocols, IoT and security aspects, cybersecurity, data, eID, quantum or digital ledger technologies (DLT), which are usually developed in specific international standardisation organisations, fora and consortia such as ISO/IEC JTC1, ITU-T, 3GPP, oneM2M, IETF or IEEE.
2. Coordinating with those partner countries to align our positions on digital standardisation in international standardisation organisations and other international fora.
3. Monitoring the effective implementation of international standards in **trade and cooperation agreements** with such targeted countries.

Key tasks:

* T1: Dedicated work stream (for ex. Joint Committee) bringing together European Commission and EU stakeholders and the relevant administrations and stakeholders of the targeted partner country, to define a common agenda and work plan, to set up a mechanism to exchange relevant information, align positions etc.
* T2: To that effect, to conduct regular studies and analyses of the relevant activities in specific target countries and in international ICT standardisation, especially in key technologies promoted in HE (AI, 5G and beyond, internet, IoT and its security aspects, cybersecurity, data, eID, QT or DLT).
* T3: Organise outreach activities such as joint international conferences, workshops or supporting material, including newsletters, websites, or promotional videos.
* T4: Cooperate, synchronise, and achieve synergies with ongoing research and innovation activities and coordination and support actions, exchange of best practices on education and awareness of ICT standards in scientific communities.

Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in defending EU values and ethics and supporting the UN Sustainable Development Goals

HORIZON-CL4-2023-HUMAN-01-66: Promoting EU standards globally (CSA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of between EUR [x – x] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 3 million. |
| *Type of Action* | Coordination and Support Actions |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Financial Support to Third Parties* | *Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted cumulative to each third party cannot exceed EUR 50 000.* |
| *Procedure* | The procedure is described in General Annex F. |
| *Links* | ***Complementary with*** ***HORIZON-CL4-2023-HUMAN-01-61 and HORIZON-CL4-2023-HUMAN-01-65*** |

Expected Outcome:

Building on the successful action of the first phase of the FPI [InDiCo](https://www.indico-ictstandards.eu/) project on international cooperation on ICT standardisation, the expected outcomes include (i) enhancing the **promotion of the EU ICT/digital standards for key technologies** in the Horizon Europe programme; (ii) the **promotion of the EU model for setting global interoperable ICT/digital standards** (stakeholder driven model) in selected targeted countries and (iii) foster **capacity building** in third countries **for ICT/digital standardisation around EU values.**

The targeted countries for capacity building are selected countries from the African Union, Latin America and Caribbean and South East Asia.

Scope: This Action will promote the EU’s human-centred agenda on the global stage and promote the alignment and convergence of international standards with EU standards, as pursued in the **Digital Compass Strategy** and in support of the **Global Gateway.** Besides, it will also enable that the targeted countries can strengthen the link between standards and their policy and regulatory framework, adopting the EU values and underpinning the **EU Digital and** the **EU Standardisation Strategy,** by:

1. **Enhancing the cooperation with the countries participating in InDiCo** (India, USA, China, South Korea, Japan, Brazil and LAC region), **and extending its geographic scope** to important areas where the EU position should be reinforced such as to the South East Asia and the African Union.
2. **Extending its technological reach to cover better technologies that are prioritized in Horizon Europe**, such as AI, 5G and beyond, IoT and its security aspects, internet, cybersecurity, data, eID, quantum, digital ledger technologies (DLT) or smart cities.
3. **capacity building in terms of digital standardisation** and thereby **facilitating alignment around EU values** and positions in international digital SDOs and other international fora (e.g. 3GPP, oneM2M, IETF, IEEE).

Indico 2.0 will of course build on the outcomes achieved in the first phase, as well as the experience gained and the studies and action that have been implemented.

Key tasks:

* T1: Activities to support effective engagement on the EU standardisation model and EU standards:
* Analysis of key Standard Development Organisations (SDOs) and countries/regions active in the priorities identified in the Commission Rolling Plan on ICT Standardisation.
* Development of case studies/best practices on the EU standardisation model and the harmonisation of global standards on priorities identified in the Commission Rolling Plan on ICT Standardisation.
* Development of common approaches, tools and guidelines, e.g., on lessons learned
* T2: Policy outreach, dialogue, and knowledge exchange activities for targeted actors. These activities will be conducted with different actors in various formats including through the organisation or participation at national and regional levels in international groups, specialised workshops, hackathons, interoperability events and roadshows. The aim will be to progressively improve a common understanding regarding the cooperation towards harmonised international open standards including the promotion of the European model, and the outreach of European ICT Standards to key countries identified in the research activity. When relevant support proof of concepts of the implementation of standards
* T3: Communication and dissemination activities to promote broader sharing of EU Data Protection Model and stimulate knowledge sharing and capitalisation.

Named beneficiaries: due to the strategic importance for the EU interests, this action is expected to be managed by the European Standardisation Organisations (CEN, CENELEC and ETSI).In this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), in particular in defending EU values and ethics and supporting the UN Sustainable Development Goals.

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| ***The ideas of the topic below (6.7) seem to display synergetic potential for joint approaches with Cluster 2 and may possibly be hosted in there.***  ***At this stage, the current elements are still presented below for awareness and early feedback but may evolve according to cross-cluster discussions.*** |

## Digital Humanism

HORIZON-CL4-2023-HUMAN-01-81: Digital Humanism - Putting people at the centre of the digital transformation (CSA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of up to EUR 1,5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. | |
| *Indicative budget* | The total indicative budget for the topic is EUR 1,5 million. | |
| *Type of Action* | | Coordination and Support Actions |
| *Lump-sums* | | **YES** |
| *Procedure* | | The procedure is described in General Annex F. |

*This project is also relevant in the policy context of the Digital Decade policy programme (“The Path to the Digital Decade”), which sets a European approach for its digital transformation based on values and technological leadership. For the first time, societal and human centred objectives are fully integrated into a comprehensive governance mechanism at EU level including monitoring of the progress made by the digital transformation in reaching our collective values and quantitative digital targets (skills, infrastructures, digitalisation of business and public services).*

*Main expected outcomes:*

* Create an active network and cross disciplinary communities on digital humanism bringing together ICT experts, ethnologists, sociologists and experts in fundamental rights
* Help defining and strengthening EU’s approach to a human-centred digital transformation through cross-disciplinary, world class foundational and application oriented research
* Formulate approaches how to transform and strengthen European standards (rule of law, social market economy, fundamental rights, social standards and social partnership) into the digital realm including the take up of those standards by digital actors and in particular those developing new digital environment (e.g. data scientists, start-ups, investors)
* Formulate a list of recommendations and roadmaps to address current gaps or issues that are preventing the development of digital solutions that will reinforce - and not undermine - digital humanism across the society
* Propose a concrete framework for measuring and promoting progress of the promotion and putting into practice of the digital rights and principles declaration in the context of the Digital Decade policy programme. This will include concrete indicators, source of information at national and EU level, as well as the identification of existing, and development of new, capacity tools to support the uptake of identified best practice uses of digital technologies in support of digital humanism. This work will notably feed the review of the Digital Decade Policy Programme and of the solemn declaration in 2026.

Scope:

A horizontal and holistic approach is needed for creating a more resilient, inclusive and democratic European society, prepared and responsive to opportunities, societal changes, threats and disasters, addressing inequalities and providing protection and high-quality public services such as health care, and empowering all citizens to act in the green and digital transitions.

While digital technologies bring strong advantages coming along with a promise of freedom and innovation, negative aspects have also become visible in the last years. These include the monopolization of the information space, increasing levels of fake news and disinformation, strong power of online platforms, cyber threats and crimes, privacy breaches, strong market disparities as well as an economic order that claims human experience as free raw material for commercial practices of extraction, prediction and sales (Zuboff, 2019).

Digital Humanism is here defined as the continuing search for a European answer to keep up high civilization standards stemming from enlightenment and the humanist era, and to further develop them in the digital world. In line with European values, such a digital environment should enable all Europeans to make full use of digital and technologies, to have a society where geographical distance matters less, so that all Europeans can benefit from the digitalisation in their daily activities (ranging from work, learning, to enjoying culture or leisure activities) but also in their interactions with governments, and participation in democratic processes.

This requires intense, cross-disciplinary work of computer (and technology) sciences with legal, economic, sociological, philosophical and other kinds of expertise as a co-development exercise. To support in-depth, early-on collaboration between computer sciences and the whole wealth of humanities and social sciences to put new algorithms and models into a broader context, proposals under this topic should:

* Support the development of cross-disciplinary communities and networks in relation to digital transformation of society. It is thus critical to foster greater exchanges between social sciences and technological communities.
* Support the cross-disciplinary co-development of new theoretical models and approaches of the impact of digital technologies in our societies, starting with human and societal needs.
* Showcasing success stories and examples of engagement of the digital community seeking to develop concrete ways to progress toward a more human-centred digital world and draw concrete conclusions from these.
* Mapping out collaborative research to develop concrete tools and frameworks for ensuring that all actors of the European digital ecosystem (policy makers, business, startup developers, investors, NGOs) can integrate in their work and activities the values that form a human centred digital transformation and develop a roadmap for the possible development of research activities
* Develop a conceptual framework as well as tools and indicators to monitor and promote the progress of the ‘declaration on digital rights and principles’ and its six chapters (putting people at the centre of the digital transformation; solidarity and inclusion; freedom of choice; participation in the digital public space; safety, security and empowerment; sustainability), notably to feed the review of the Digital Decade Policy Programme and of the solemn declaration in 2026.

## Cross-cutting International

The proposed international cooperation and support actions are aligned with the Commission’s international priorities. They will help build strong international digital partnerships, and promote a human-centred digital agenda. International cooperation will further a level playing field and reciprocity while delivering new solutions to digital challenges. The proposed actions will be involved in trade and industrial policy aspects by promoting European technologies in key international markets. They will also support digital dialogues with partner countries.

Cooperation will be prioritised with the U.S. in the context of the Trade and Technology Council, and with Japan, the Republic of Korea, and Singapore as part of our digital partnerships with countries in the Indo-Pacific region. Cooperation with countries in sub-Saharan Africa will stimulate R&I cooperation with the EU and promote EU values for a human-centric digital transformation.

Additionally, international collaboration is encouraged or targeted in several thematic areas such as Cognitive Computing Continuum (Japan, South Korea), Quantum and HPC (Japan, S. Korea, India), Efficient Trustworthy AI (Canada, India), and Promoting NGI solutions globally (U.S. and Canada). International cooperation in a number of other technological areas may also be addressed within the respective Joint Undertakings (Smart Networks and Services, EuroHPC, and Key Digital Technologies).

HORIZON-CL4-2023-HUMAN-91: International Hub for Digital Partnerships (CSA)

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| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 4 million. |

Expected outcomes:

* Support R&I activities linked to implementing Digital Partnerships with Japan, the Republic of Korea, and Singapore.
* Support R&I activities in the context of the Trade and Technology Council (TTC) with the U.S.
* Support to digital dialogues with international partners.
* Oversee international activities across Horizon Europe Cluster 4, and identify joint research and industrial cooperation opportunities with key partners.
* Report on synergies and commonalities in policies, strategies and programmes between the EU and partner countries.
* Foster increased cooperation with the U.S. National Science Foundation (NSF) and other US agencies and research institutions on R&I activities in the field of digital.
* Support to trade and industrial policy aspects by promoting European technologies in key international markets.
* Promote and support European positions in international such as G7, G20, OECD, WTO, etc.

Proposals are expected to:

* Organize networks, conferences, workshops and other actions that support R&I activities in the Digital Partnerships with Japan, South Korea and Singapore, and promote R&I cooperation with the U.S. in the context of the TTC.
* Collect and analyse information as well conduct surveys and draft reports and position papers on partner countries’ R&I policies, strategies and programmes, including on data governance and data technologies.
* Foster cooperation and prepare ground for joint research and raise greater awareness of R&I and industrial cooperation opportunities.
* The action should ensure that relevant stakeholders from both EU and the partner countries sides are engaged during the process through regional and international workshops and a set of communication and dissemination actions.
* Increased networking and collaboration of stakeholders from the EU and the partner countries.

HORIZON-CL4-2023-HUMAN-92: R&I cooperation with Sub-Saharan Africa (CSA)

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| **Specific conditions** | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR 3 million. |
| *Type of Action* | Coordination and Support Action |

Expected outcomes:

* Stimulate R&I cooperation between Sub-Saharan Africa and the EU in the field of digital.
* Strengthen strategic partnerships and support digital dialogues with countries in sub-Saharan Africa.
* Support to trade and industrial policy aspects by promoting European technologies in African markets.
* Contribute through African R&I to the Sustainable Development Goals (SDGs).
* Promote EU values for a human-centric digital transformation.
* Support EU’s international priorities, as set out in Europe’s digital decade.
* Build synergies and prepare an enabling environment for research and investment for the EU.

Proposals are expected to:

* Foster cooperation and prepare ground for joint research and raise greater awareness of R&I cooperation opportunities between the EU and sub-Saharan Africa.
* Organize networks, conferences, workshops and other actions that support R&I activities and monitor digital-relevant activities in sub-Saharan Africa.
* Collect and analyse information as well conduct surveys and draft reports and position papers on sub-Saharan African countries’ R&I policies, strategies and programmes.
* Link EU and African internet R&I communities, building on the work of existing projects such as the African-European Digital Innovation Bridge (AEDIB) and the FPI project “Open Internet in Africa”.
* The action should ensure that relevant stakeholders from both EU and African countries are engaged during the process through regional and international workshops and a set of communication and dissemination actions.

HORIZON-CL4-2023-HUMAN-93: R&I cooperation with Latin America (Mexico, Brazil) (CSA)

Specific ideas for collaboration with Latin America are being developed and may feature in the next version of the draft work programme.

OTHER ACTIONS NOT SUBJECT TO CALLS FOR PROPOSALS

Grants to identified beneficiaries

1. HORIZON-CL4-2024-QUANTUM-01-SGA: Developing large-scale quantum Computing platform technologies (SGA)

|  |  |
| --- | --- |
| **Specific conditions** | |
| *Expected EU contribution per project* | EUR [24-26] million |
| *Indicative budget* | EUR [24-26] million |
| *Type of Action* | Specific Grant Agreement |
| *Technology Readiness Level* | Activities are expected to start at TRL 4-5 and achieve TRL 6-7 by the end of the project – see General Annex B. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Article 22.5* | In order to achieve the expected outcomes, and safeguard the Union’s strategic assets, interests, autonomy, and security, it is important to avoid a situation of technological dependency on a non-EU source, in a global context that requires the EU to take action to build on its strengths, and to carefully assess and address any strategic weaknesses, vulnerabilities and high-risk dependencies which put at risk the attainment of its ambitions. For this reason, participation is limited to legal entities established in Member States, Iceland and Norway.  For the duly justified and exceptional reasons listed in the paragraph above, in order to guarantee the protection of the strategic interests of the Union and its Member States, entities established in an eligible country listed above, but which are directly or indirectly controlled by a non-eligible country or by a non-eligible country entity, may not participate in the action unless it can be demonstrated, by means of guarantees provided by their eligible country of establishment, that their participation to the action would not negatively impact the Union’s strategic, assets, interests, autonomy, or security. The guarantees shall in particular substantiate that, for the purpose of the action, measures are in place to ensure that:  a) control over the applicant legal entity is not exercised in a manner that retrains or restricts its ability to carry out the action and to deliver results, that imposes restrictions concerning its infrastructure, facilities, assets, resources, intellectual property or know-how needed for the purpose of the action, or that undermines its capabilities and standards necessary to carry out the action;  b) access by a non-eligible country or by a non-eligible country entity to sensitive information relating to the action is prevented; and the employees or other persons involved in the action have a national security clearance issued by an eligible country, where appropriate;  c) ownership of the intellectual property arising from, and the results of, the action remain within the recipient during and after completion of the action, are not subject to control or restrictions by non-eligible countries or non-eligible country entity, and are not exported outside the eligible countries, nor is access to them from outside the eligible countries granted, without the approval of the eligible country in which the legal entity is established. |

Expected Outcome: Within the Framework Partnership Agreement (FPA) awarded under topic HORIZON-CL4-2023-DIGITAL-EMERGING-01-FPA: Framework Partnership Agreement for developing large-scale quantum computers (FPA), the selected consortia will be invited to submit a proposal that will implement the first 3.5 years of the action plan defined in the above FPA.

The proposal must progress the quantum computing platform in accordance with the research roadmap as defined in the FPA. This covers in particular progress in key areas such as the number of qubits to reach and the scalability potential, the fidelity / physical error rate, the further development of the underlying quantum computing processors and the low-level control of the programmability capability, the standardisation aspects, etc.

The proposal should describe how the activities carried out during the ramp-up phase will be continued involving the relevant disciplines and stakeholders, how results of the ramp-up phase will be used, and how they will provide efficient coordination under strong scientific leadership. The proposal should identify the different gaps, describe in detail activities in areas such as education, dissemination, ethics and societal aspects. It should also describe how it will grasp the technological potential in a way that accelerates innovation in all relevant application areas. Partners will be required to give other partners access to results needed for the purpose of any other specific actions under the FPA.

The proposal should also cover: (i) the cooperation with complementary projects launched specifically in the area of the enabling quantum software stack (see HORIZON-CL4-2021-DIGITAL-EMERGING-02-10: Strengthening the quantum software ecosystem for quantum computing platforms), including also the need to establish from the beginning of this cooperation appropriate IP exploitation agreements; (ii) the collaboration with other initiatives or programmes at regional, national, transnational or global level; (iii) any additional support they may receive from relevant national, or regional programmes and initiatives; and (iv) contribution to the governance and overall coordination of the Quantum Technologies Flagship initiative; and (v) relevant aspects of cooperation with European industry and SMEs. It should also contribute to spreading excellence across Europe; for example, through the involvement of Widening Countries.

The standard evaluation criteria, thresholds, weighting for award criteria and the maximum rate of co-financing for this type of action are provided in parts C and E of the General Annexes.

In this action the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

1. HORIZON-CL4-2023-NGI-01-SGA - Developing the first stage of Next Generation Internet commons (SGA)

|  |  |
| --- | --- |
|  | |
| *Expected EU contribution per project* | The Commission estimates that an EU contribution of EUR [27-29] million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts. |
| *Indicative budget* | The total indicative budget for the topic is EUR [27-29] million. |
| *Type of Action* | Specific Grant Agreement |
| *Technology Readiness Level* | N. A. |
| *Legal and financial set-up of the Grant Agreements* | The rules are described in General Annex G. |
| *Award criteria* | The criteria are described in General Annex D.  The following additional criteria will apply to HORIZON-CL4-2023-HUMAN-01-11 under “3 Quality and efficiency of the implementation”:  “Capacity of the consortium to create, grow and move to sustainability internet commons based on open source software, hardware, design and standards”. |

Objective of the SGA

Within the Framework Partnership Agreement (FPA) awarded under topic “HORIZON-CL4-2023-HUMAN-01-NN: Framework Partnership Agreement for the Next Generation Internet commons”, the selected consortium will be invited to submit a proposal that will implement the first 3 years of the above FPA and covering its full scope.

Expected Outcome: Projects are expected to contribute to the following outcomes:

* The SGA should contribute to a flourishing internet, based on common building blocks created within NGI, that enables better control of our digital life, respects our privacy, permits better sharing of data (including personal and non-personal) based on users’ preferences, and enables better socio-economic impact based on improved trust.
* A mobilisation of at least 1000 innovators driving the evolution of a human centric internet
* At the end of the SGA, a minimum of 4 strategic projects achieving autonomy for example by reaching legal establishment status, bringing in non-Horizon Europe source of funding or having a critical mass of innovators contributing to it.
* Synergies with NGI pilots as well as with other relevant actions in Europe and outside.

Scope:

Proposers should setup a continuous open call environment addressing open source communities and implementing the requirements for financial support for third parties in terms of transparency, publicity, confidentiality, fair treatment, and handling of conflict of interest.

The calls should explore the full internet stack (both server and devices) from open hardware to applications with the aim of shaping Internet commons with improved trust, privacy, portability, discoverability, inclusion with better sharing and search of personal and non-personal data with advanced identity management, implementing optimal balance between decentralisation, security and energy efficiency and ensuring more socio-economic benefits.

Proposers should strive for identification of common tools and stimulate maximum re-use among funded projects e.g. interoperable identity and credential management tools, common packaging solutions, tools for decentralised social media, when relevant.

Proposers should publicise calls towards the open source communities actively influencing the course of the Internet commons.

Proposers should detail the services that would be offered for maturing third parties projects including security and accessibility audits, packaging of the software for easy deployment, localisation of the software in EU languages, documentation best practices and advising on licensing.

The path to growth should detail how projects will gain critical mass, what services will be provided when reaching such stage, what governance models can be advised, what strategy for standardisation, what funding models for sustainability.

Proposers should actively manage the portfolio of funded projects and provide a coherent overall picture, describing how mature the solution is by giving details on audits made and ensuring trusted and easy deployment capabilities for each building blocks.

The governance model of the project should detail how the EU policies can be translated into call for action e.g. in relation to European strategic autonomy and the maintenance strategy for the future commons.

Proposers should create the conditions for successful collaboration with NGI pilot actions as well as other ongoing NGI actions such as the outreach office and actions in the area of trust, search and international.

Proposers should seek active collaborations with other funding efforts addressing internet commons at European and national levels and beyond Europe.

1. Critical Raw Materials Exploration Investment Facility with the European Bank for Reconstruction and Development (EBRD)

**Description:**

The EU green and digital transitions will continuously increase the demand for raw materials. As far as the development of technologies and markets for secondary raw materials will increase, covering some of the demand, primary raw materials will remain an important source of raw materials.

Europe is rich in resources that should be explored and analysed in the context for potential future uptake by investment projects. Novel, innovative technologies for exploration are being funded through EU programmes. However, the next barrier is their utilisation. Mineral exploration activities requires high investments which are associated with high financial risk, due to the uncertainty of the final outcome. . As a consequence, a sub-optimal amount of resources are invested in exploration activities.

In order to support the sustainable supply of raw materials , the European Commission and the EBRD seek to pilot a financial instrument to provide access to finance, in the form of equity or quasi-equity, to companies performing sustainable exploration in Europe through novel technologies. The facility can also target investment cases aiming at exploiting the technologies developed with the support of EU Framework Programmes for Research and Innovation.

This activity will contribute to the implementation of the following action from the Critical Raw Materials Action Plan, COM(2020) 474:

*Action 5 - Identify mining and processing projects and investment needs and related financing opportunities for critical raw materials in the EU that can be operational by 2025, with priority for coal-mining regions (Commission, Member States, regions, stakeholders);*

Further details regarding the underlying financial structure, including the risk-sharing arrangement between the Commission and the EBRD, the allocation of annual commitment and eligibility rules related to blending operations will be specified in the Guarantee Agreement (or in an amendment to it) signed under InvestEU.

This action directly aimed at supporting the development and implementation of evidence base for R&I policies and supporting various groups of stakeholders is excluded from the delegation to the Executive Agencies and will be implemented by the Commission services.

**Type of Action:** Financial Instrument

**Indicative timetable:** XXXQ1 2023XXX

**Indicative budget:**EUR 25 million from the 2023 budget

1. UNECE resource management system

UNECE-EGRM Secretariat The United Nations Economic Commission for Europe (UNECE) is one of the five regional commissions of the United Nations. Its Expert Group on Resource Management (EGRM) has developed the United Nations Framework Classification for Resources (UNFC), an UNendorsed, universally accepted and internationally applicable classification scheme for energy and mineral resources. The EGRM is developing classifications for other resources (solar, geothermal, hydro, wind and bio-energy resources, anthropogenic resources). EGRM is building on that framework to develop a dynamic system for sustainable management of resources (United Nations Resource Management System, or UNRMS).

The Commission will contribute on behalf of the EU to the UNECE-EGRM secretariat to further develop a unified, comparable, interoperable and harmonised system for resource assessment usable for governmental, statistical, corporate and financial purposes; to support the capacity and knowledge foundations for UNFC and UNRMS; to communicate the activities, deliverables and findings of the EGRM, including policy tools; and to synthesize, review, assess and critically evaluate relevant information and knowledge on resource management. The financial contribution will support, inter alia, the preparation and dissemination of reports, such as a tool-kit for sustainable management of resources for governments; refining UNFC- and UNRMS-based reporting codes and application guidelines; the preparation of case studies and application examples at country and corporate levels; high-level consultations with investment banks, development banks and other financial institutions; engaging experts and facilitate participation of experts from the EU, associated and third countries in this process; facilitate setting up a network of International Centres on sustainable management of resources; coordination with key institutions; communicating about deliverables and findings, conducting multi-stakeholder workshops and training courses; and strengthening the synergies between EU funded actions and UNECE outputs on UNFC and UNRMS. The action will also support the organisation of high-level dissemination events in the EU, targeting policy makers and other relevant stakeholders, in order to provide timely, high-quality and policy-relevant information and strengthen the dialogue on resources and the 2030 Agenda for Sustainable Development.

**Legal entities:** UNECE, Palais des Nations, CH-1211 Geneva 10, Switzerland

**Type of Action:** Contribution agreement with an implementing entity (indirect management)

**Indicative timetable:** 2023

**Indicative budget:** EUR 3 million from the 2023 budget

1. JRC Support to Energy Intensive Industries and Strategic Technologies value chains

**Objective:** To continue the collaboration with the JRC on various aspects of the transition of energy-intensive industries, raw materials value chain analysis and raw materials for industrial ecosystems (EIGL, Foresight)..

**Duration:** 24 months

**Form of Funding:** Direct action grants

**Type of Action:** Provision of technical/scientific services by the Joint Research Centre

**Indicative timetable:** Q1 20242023

**Indicative budget:** EUR 1,5 million from the 2023 budget

1. Raw Materials events

It is envisaged to procure activities for the organisation of events (conferences, workshops or seminars), including the Raw Materials Week through Framework Contracts before the end of 2023 and 2024.

DG GROW is organising the Raw Materials Week in the fourth calendar quarter of 2023 and 2024, covering set of events including the High Level Conference of the European Innovation Partnership (EIP) on Raw Materials.

**Form of Funding:** Procurement

**Type of Action:**Public procurement- Framework contract

**Indicative timetable:**Q4 2023 and Q4 2024

**Indicative budget:**EUR 0,6 million from the 2023 budget and EUR 0,6 million from the 2024

1. Support to Hydrogen in the Economy

The Commission represents the European Union in the International Partnership for Hydrogen and Fuel Cells in the Economy. The annual financial contribution will be paid to the entity responsible for managing it.

**Type of Action:**Subscription action

**Indicative timetable:** as of 1st quarter 2023, as of 1st quarter 2024

**Indicative budget:**EUR 0,05 million from the 2023 budget and EUR 0,05 million from the 2024 budget

1. JRC Support to the SSbD Criteria

**Objective:** ...

**Duration:** 24 months

**Form of Funding:** Direct action grants

**Type of Action:** Provision of technical/scientific services by the Joint Research Centre

**Indicative timetable:** Q1 2023

**Indicative budget:** EUR 500000 from the 2024 budget

1. Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning\_fair\_into\_reality\_1.pdf [↑](#footnote-ref-2)
2. Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning\_fair\_into\_reality\_1.pdf [↑](#footnote-ref-3)
3. That could follow Innovation Fund methodology: <https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/innovfund/wp-call/2021/call-annex_c_innovfund-lsc-2021_en.pdf> [↑](#footnote-ref-4)
4. That could follow Innovation Fund methodology: <https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/innovfund/wp-call/2021/call-annex_c_innovfund-lsc-2021_en.pdf> [↑](#footnote-ref-5)
5. The use of hydrogen as fuel/energy carrier is excluded from the scope of the topic [↑](#footnote-ref-6)
6. That should follow Innovation Fund methodology: <https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/innovfund/wp-call/2021/call-annex_c_innovfund-lsc-2021_en.pdf> [↑](#footnote-ref-7)
7. Building on previous and ongoing related projects either from specific sectors or across different sectors notably as discussed at Energy Modelling Platform for the EU: <https://www.energymodellingplatform.eu/> [↑](#footnote-ref-8)
8. In line with Sustainable Products Initiative: <https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en> [↑](#footnote-ref-9)
9. Cf Sustainable Carbon Cycles Communication (COM (2021) 800 final [↑](#footnote-ref-10)
10. compared to buildings sector or power generation [↑](#footnote-ref-11)
11. The website will be updated shortly with much more detailed info and examples

    <https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-manufacturing_en#hubs-for-circularity-h4c> [↑](#footnote-ref-12)
12. The website will be updated shortly with much more detailed info and examples https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-manufacturing\_en#hubs-for-circularity-h4c [↑](#footnote-ref-13)
13. A social innovation spin-off action may not necessarily encompass a commercial activity. [↑](#footnote-ref-14)
14. Resource in the context of this topic means material as energy or water efficiency are covered by topics TWIN-TRANSITION-01-31: Energy efficiency breakthroughs in the process industries (Processes4Planet partnership) (RIA) and HORIZON-CL4-2024-TWIN-TRANSITION-01-40 : Sustainable and efficient industrial water consumption: through energy and solute recovery, topics [↑](#footnote-ref-15)
15. HORIZON-CL4-2021-TWIN-TRANSITION-01-17: Plastic waste as a circular carbon feedstock for industry (Processes4Planet Partnership) (IA) [↑](#footnote-ref-16)
16. <https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf> [↑](#footnote-ref-17)
17. <https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf> [↑](#footnote-ref-18)
18. <https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf> [↑](#footnote-ref-19)
19. In the CSP SRIA "biomass" means the biodegradable fraction of products, waste and residues from biological origin from agriculture, including vegetal and animal substances, from forestry and related industries, including fisheries and aquaculture, as well as the biodegradable fraction of waste, including industrial and municipal waste of biological origin as defined in the Directive of the European Parliament and the Council on the promotion of the use of energy from renewable sources (EU,2018). [↑](#footnote-ref-20)
20. <https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf> [↑](#footnote-ref-21)
21. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-22)
22. COM (2020) 474 [↑](#footnote-ref-23)
23. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-24)
24. COM (2020) 474 [↑](#footnote-ref-25)
25. <https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en> [↑](#footnote-ref-26)
26. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-27)
27. COM (2020) 474 [↑](#footnote-ref-28)
28. Ref list of EU CRMs 2020 [↑](#footnote-ref-29)
29. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-30)
30. COM (2020) 474 [↑](#footnote-ref-31)
31. Ref list of EU CRMs 2020 [↑](#footnote-ref-32)
32. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-33)
33. COM (2020) 474 [↑](#footnote-ref-34)
34. ## With the exception of permanent magnets in motors which are included in action 11: ERMA action plan on rare earths magnets: Recyclability and resource efficiency of Rare Earth based magnets

    [↑](#footnote-ref-35)
35. With the exception of permanent magnets in motors which are included in action 11: ERMA action plan on rare earths magnets: Recyclability and resource efficiency of Rare Earth based magnets [↑](#footnote-ref-36)
36. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-37)
37. COM (2020) 474 [↑](#footnote-ref-38)
38. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-39)
39. COM (2020) 474 [↑](#footnote-ref-40)
40. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-41)
41. COM (2020) 474 [↑](#footnote-ref-42)
42. https://erma.eu/european-call-for-action/ [↑](#footnote-ref-43)
43. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-44)
44. COM (2020) 474 [↑](#footnote-ref-45)
45. https://erma.eu/european-call-for-action/ [↑](#footnote-ref-46)
46. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-47)
47. COM (2020) 474 [↑](#footnote-ref-48)
48. https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1 [↑](#footnote-ref-49)
49. COM (2020) 474 [↑](#footnote-ref-50)
50. https://ec.europa.eu/growth/news/eu-and-canada-set-strategic-partnership-raw-materials-2021-06-21\_en [↑](#footnote-ref-51)
51. https://www.go-fair.org/fair-principles/ [↑](#footnote-ref-52)
52. Reference to updated industrial research site on Europa.eu to be added which will link to the relevant Commission documents: Already available ‘[Review of safety and sustainability dimensions, aspects, methods, indicators, and tools](https://publications.jrc.ec.europa.eu/repository/handle/JRC127109)’, under consultation ‘Framework for the definition of criteria and evaluation procedure for chemicals and materials’. [↑](#footnote-ref-53)
53. Link to be added after adoption. [↑](#footnote-ref-54)
54. https://ec.europa.eu/environment/ecolabel/the-ecolabel-scheme.html [↑](#footnote-ref-55)
55. https://ec.europa.eu/environment/chemicals/reach/reach\_en.htm [↑](#footnote-ref-56)
56. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/cancer\_en [↑](#footnote-ref-57)
57. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/healthy-oceans-seas-coastal-and-inland-waters\_en [↑](#footnote-ref-58)
58. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food\_en [↑](#footnote-ref-59)
59. https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX%3A32008R0440 [↑](#footnote-ref-60)
60. https://www.oecd.org/chemicalsafety/testing/oecd-guidelines-testing-chemicals-related-documents.htm [↑](#footnote-ref-61)
61. https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc [↑](#footnote-ref-62)
62. https://www.go-fair.org/fair-principles/ [↑](#footnote-ref-63)
63. https://ipchem.jrc.ec.europa.eu/ [↑](#footnote-ref-64)
64. https://ec.europa.eu/environment/pdf/chemicals/2020/10/Strategy.pdf [↑](#footnote-ref-65)
65. Link to JRC document on academic data for OCDP [↑](#footnote-ref-66)
66. Reference to website were Strategic Research and Innovation Plan will be published. [↑](#footnote-ref-67)
67. https://www.bmu.de/en/topics/health-chemicals/nanotechnology/the-malta-initiative [↑](#footnote-ref-68)
68. <https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan_en>: [↑](#footnote-ref-69)
69. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/cancer\_en [↑](#footnote-ref-70)
70. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/healthy-oceans-seas-coastal-and-inland-waters\_en [↑](#footnote-ref-71)
71. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food\_en [↑](#footnote-ref-72)
72. Reference to updated industrial research site on Europa.eu to be added which will link to the relevant Commission documents: Already available ‘[Review of safety and sustainability dimensions, aspects, methods, indicators, and tools](https://publications.jrc.ec.europa.eu/repository/handle/JRC127109)’, under consultation ‘Framework for the definition of criteria and evaluation procedure for chemicals and materials’. [↑](#footnote-ref-73)
73. https://www.go-fair.org/fair-principles [↑](#footnote-ref-74)
74. Link to JRC document on academic data for OCDP [↑](#footnote-ref-75)
75. <https://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/ec_rtd_he-partnerships-chemical-risk-assessment.pdf>, https://www.efsa.europa.eu/en/funding-calls/european-partnership-assessment-risks-chemicals-parc (to be updated) [↑](#footnote-ref-76)
76. https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl4-2021-resilience-01-08 [↑](#footnote-ref-77)
77. Reference to website were Strategic Research and Innovation Plan will be published. [↑](#footnote-ref-78)
78. Reference to updated industrial research site on Europa.eu to be added which will link to the relevant Commission documents: Already available ‘[Review of safety and sustainability dimensions, aspects, methods, indicators, and tools](https://publications.jrc.ec.europa.eu/repository/handle/JRC127109)’, under consultation ‘Framework for the definition of criteria and evaluation procedure for chemicals and materials’ [↑](#footnote-ref-79)
79. https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan\_en [↑](#footnote-ref-80)
80. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/cancer\_en [↑](#footnote-ref-81)
81. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/healthy-oceans-seas-coastal-and-inland-waters\_en [↑](#footnote-ref-82)
82. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food\_en [↑](#footnote-ref-83)
83. Preliminary definition as provided in the Chemicals Strategy for Sustainability: Substances “having a chronic effect for human health or the environment (Candidate list in REACH and Annex VI to the CLP Regulation) but also those which hamper recycling for safe and high quality secondary raw materials.” [↑](#footnote-ref-84)
84. Link to JRC document on academic data for OCDP [↑](#footnote-ref-85)
85. Reference to be added to revised industrial research website [↑](#footnote-ref-86)
86. Reference to website were Strategic Research and Innovation Agenda will be published. [↑](#footnote-ref-87)
87. https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc [↑](#footnote-ref-88)
88. https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl4-2021-resilience-01-08 [↑](#footnote-ref-89)
89. Reference to updated industrial research site on Europa.eu to be added which will link to the relevant Commission documents: Already available ‘[Review of safety and sustainability dimensions, aspects, methods, indicators, and tools](https://publications.jrc.ec.europa.eu/repository/handle/JRC127109)’, under consultation ‘Framework for the definition of criteria and evaluation procedure for chemicals and materials’ [↑](#footnote-ref-90)
90. https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan\_en [↑](#footnote-ref-91)
91. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/cancer\_en [↑](#footnote-ref-92)
92. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/healthy-oceans-seas-coastal-and-inland-waters\_en [↑](#footnote-ref-93)
93. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food\_en [↑](#footnote-ref-94)
94. JRC report on criteria [↑](#footnote-ref-95)
95. Link to JRC document on academic data for OCDP [↑](#footnote-ref-96)
96. Reference to website were Strategic Research and Innovation Agenda will be published. [↑](#footnote-ref-97)
97. https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/horizon-cl4-2021-resilience-01-08 [↑](#footnote-ref-98)
98. https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc [↑](#footnote-ref-99)
99. https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan\_en [↑](#footnote-ref-100)
100. https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/soil-health-and-food\_en [↑](#footnote-ref-101)
101. https://ec.europa.eu/info/sites/default/files/research\_and\_innovation/research\_by\_area/documents/advanced-materials-2030-manifesto.pdf [↑](#footnote-ref-102)
102. Reference to updated industrial research site on Europa.eu to be added which will link to the relevant Commission documents: Already available ‘Review of safety and sustainability dimensions, aspects, methods, indicators, and tools’, under consultation ‘Framework for the definition of criteria and evaluation procedure for chemicals and materials’. [↑](#footnote-ref-103)
103. the EFSA Guidance on risk assessment of nanomaterials to be applied in the food and feed chain: human and animal health including Appendices D.2 for pesticides, D.5 for nanocarriers and D.6 for fertilisers; https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2021.6768 [↑](#footnote-ref-104)
104. https://www.efsa.europa.eu/en/efsajournal/pub/4499 [↑](#footnote-ref-105)
105. https://www.go-fair.org/fair-principles/ [↑](#footnote-ref-106)
106. https://ipchem.jrc.ec.europa.eu/ [↑](#footnote-ref-107)
107. http://www.enanomapper.net/ [↑](#footnote-ref-108)
108. https://eplca.jrc.ec.europa.eu/ [↑](#footnote-ref-109)
109. Reference to updated industrial research site on Europa.eu to be added, which will link to the relevant Commission documents: Already available ‘Review of safety and sustainability dimensions, aspects, methods, indicators, and tools’, under consultation ‘Framework for the definition of criteria and evaluation procedure for chemicals and materials’. [↑](#footnote-ref-110)
110. HORIZON-CL6-2022-CIRCBIO-02-03-two-stage: Sustainable biodegradable novel bio-based plastics: innovation for sustainability and end-of-life options of plastics

     HORIZON-CL6-2023-CIRCBIO: Programmed biodegradation capability of bio-based materials and products, validated in specific environments including extreme environments [↑](#footnote-ref-111)
111. COM(2021) 550 final [↑](#footnote-ref-112)
112. <https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/advanced-materials-2030-manifesto.pdf> [↑](#footnote-ref-113)
113. DT-NMBP-39-2020 - Towards Standardised Documentation of Data through taxonomies and ontologies [↑](#footnote-ref-114)
114. Reference to be copied from SSbD topcis [↑](#footnote-ref-115)
115. The Advanced Technologies for Industry project of the European Commission offers analytical overview of 16 advanced technologies: <https://ati.ec.europa.eu/about/what-is-ati>: *Advanced Manufacturing Technology, Advanced Materials, Artificial Intelligence, Augmented and Virtual Reality, Big Data, Blockchain, Cloud Computing, Connectivity, Industrial Biotechnology, Internet of Things, Micro- and Nanoelectronics, Mobility, Nanotechnology, Photonics, Robotics and Security.* European SMEs have shown a chronic lagging behind the US and China in the uptake of advanced technologies [↑](#footnote-ref-116)
116. See ATI reports from US and China about technology performance:

     China: <https://ati.ec.europa.eu/reports/international-reports/report-china-technological-capacities-and-key-policy-measures> ; and

     US: <https://ati.ec.europa.eu/reports/international-reports/report-united-states-america-technological-capacities-and-key-policy>

     <https://intellectual-property-helpdesk.ec.europa.eu/index_en>;

     <https://intellectual-property-helpdesk.ec.europa.eu/horizon-ip-scan_en>;

     <https://euipo.europa.eu/ohimportal/en/online-services/ideas-powered-for-business> [↑](#footnote-ref-117)
117. *https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662* [↑](#footnote-ref-118)
118. <https://europa.eu/new-european-bauhaus/index_nl> [↑](#footnote-ref-119)
119. Refers to the 14 Industrial Ecosystems for Recovery [↑](#footnote-ref-120)
120. https://jpi-urbaneurope.eu/ped/ [↑](#footnote-ref-121)
121. FAIR = Findable, Accessible, Interoperable, Re-usable [↑](#footnote-ref-122)
122. [Levels of Autonomy for Field Robots — EarthSense](https://www.earthsense.co/news/2020/7/24/levels-of-autonomy-for-field-robots#:~:text=Level%203%20Autonomy%3A%20In%20many%20industries%2C%20Level%203,single%20human%20can%20monitor%20a%20number%20of%20robots.) [↑](#footnote-ref-123)
123. <https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662906/IPOL_STU(2021)662906_EN.pdf> [↑](#footnote-ref-124)
124. [↑](#footnote-ref-125)
125. <https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662906/IPOL_STU(2021)662906_EN.pdf> [↑](#footnote-ref-126)
126. A first experimental pilot line for 2d materials was established in 2020 under the Graphene Flagship initiative: <https://graphene-flagship.eu/news/Pages/Europe-developing-its-first-experimental-pilot-line-for-2D-materials-.aspx> [↑](#footnote-ref-127)
127. Noisy intermediate scale quantum [↑](#footnote-ref-128)
128. Alternative to mainstream Silicon CMOS technologies. [↑](#footnote-ref-129)
129. Multi-functional interface for OOS applications providing at least transfer of mechanical loads, power and data (e.g. HOTDOCK, iSSI or SIROM) [↑](#footnote-ref-130)
130. Published on the EU funding and tenders portal (https://ec.europa.eu/info/fundingtenders/opportunities/portal) [↑](#footnote-ref-131)
131. www.h2020-peraspera.eu [↑](#footnote-ref-132)
132. www.epic-src.eu [↑](#footnote-ref-133)
133. www.h2020-peraspera.eu/EOF [↑](#footnote-ref-134)
134. This excludes full launcher development [↑](#footnote-ref-135)
135. <https://eur-lex.europa.eu/legal-content/EN/AUTO/?uri=uriserv:OJ.L_.2021.170.01.0069.01.ENG&toc=OJ:L:2021:170:TOC> [↑](#footnote-ref-136)
136. [EU Mission: Climate-Neutral and Smart Cities | European Commission (europa.eu)](https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/missions-horizon-europe/climate-neutral-and-smart-cities_en). [↑](#footnote-ref-137)
137. for example through the Network of governmental Users (NoU) of secure SatCom services identified in the ENTRUSTED project [↑](#footnote-ref-138)
138. <https://eur-lex.europa.eu/legal-content/EN/AUTO/?uri=uriserv:OJ.L_.2021.170.01.0069.01.ENG&toc=OJ:L:2021:170:TOC> [↑](#footnote-ref-139)
139. <https://eur-lex.europa.eu/legal-content/EN/AUTO/?uri=uriserv:OJ.L_.2021.170.01.0069.01.ENG&toc=OJ:L:2021:170:TOC> [↑](#footnote-ref-140)
140. <https://hellofuture.orange.com/en/towards-a-less-data-and-energy-intensive-ai/> [↑](#footnote-ref-141)
141. All official EU as well as socially and commercially relevant languages. [↑](#footnote-ref-142)
142. Focus on all official EU as well as socially and commercially relevant languages. [↑](#footnote-ref-143)
143. The projects beneficiaries will compete in a separate track, not eligible for prize money, given that they already receive EU funding. [↑](#footnote-ref-144)
144. This concerns topics CL4-2024-HUMAN-01-01, CL4-2024-HUMAN-01-02 [↑](#footnote-ref-145)
145. Projects funded under the following calls/topics: H2020-ICT48, HORIZON-CL4-2021-HUMAN-01-03HORIZON-CL4-2022-HUMAN-02-02) [↑](#footnote-ref-146)
146. [A European approach to artificial intelligence | Shaping Europe’s digital future (europa.eu)](https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence) [↑](#footnote-ref-147)
147. Research should complement build upon and collaborate with projects funded under topic HORIZON-CL4-2023-HUMAN-01-03: Natural Language Understanding and Interaction in Advanced Language Technologies [↑](#footnote-ref-148)
148. The term industry in this context encompasses all ecosystems defined in the [European industrial strategy](https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en) [↑](#footnote-ref-149)
149. A9-0284/2021 [↑](#footnote-ref-150)
150. Council conclusions on "Accelerating knowledge circulation in the EU" adopted on 29 May 2018; SRIP Report - Science, Research and Innovation Performance of the EU 2020. [↑](#footnote-ref-151)
151. Council Recommendation (EU) 2021/2122 of 26 November 2021 on a Pact for Research and Innovation in Europe (ST/13701/2021/INIT) [↑](#footnote-ref-152)
152. Policy Report “Towards a 2030 Vision on the Future of Universities in Europe” <https://ec.europa.eu/info/publications/towards-2030-vision-future-universities-field-ri-europe_en> [↑](#footnote-ref-153)
153. As regards the scope of the topic, the term industry refers to economic activities within any of 14 Industrial Ecosystems identified in the revised European industrial strategy (<https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en>), without prejudice to the exclusive focus on civil applications of Horizon Europe. The 14 Industrial Ecosystems are: aerospace and defence, agri-food, construction, cultural and creative industries, digital, electronics, energy intensive industries, energy-renewables, health, mobility – transport – automotive, proximity, social economy and civil security, retail, textile and tourism. [↑](#footnote-ref-154)
154. As relevant, including the projects resulting from HORIZON-CL4-2021-HUMAN-01-26, HORIZON-CL4-2023-HUMAN-01-21/22 and HORIZON-CL4-2023-HUMAN-01-52 [↑](#footnote-ref-155)
155. such as Manufuture, Cecimo, Orgalim and others. [↑](#footnote-ref-156)
156. The Universal Declaration on Human Rights, the International Covenant on Economic, Social and Cultural Rights, the European Convention on Human Rights and the Charter of Fundamental Rights of the European Union [↑](#footnote-ref-157)
157. As relevant, including the projects resulting from HORIZON-CL4-2021-HUMAN-01-26, HORIZON-CL4-2023-HUMAN-01-21/22 and HORIZON-CL4-2023-HUMAN-01-52 [↑](#footnote-ref-158)
158. such as Manufuture, Cecimo, Orgalim and others. [↑](#footnote-ref-159)
159. As regards the scope of the topic, the term industry refers to economic activities within any of 14 Industrial Ecosystems identified in the revised European industrial strategy (<https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-industrial-strategy_en>), without prejudice to the exclusive focus on civil applications of Horizon Europe. The 14 Industrial Ecosystems are: aerospace and defence, agri-food, construction, cultural and creative industries, digital, electronics, energy intensive industries, energy-renewables, health, mobility – transport – automotive, proximity, social economy and civil security, retail, textile and tourism. [↑](#footnote-ref-160)
160. As relevant, including the projects resulting from HORIZON-CL4-2021-HUMAN-01-26, HORIZON-CL4-2023-HUMAN-01-21/22 and HORIZON-CL4-2023-HUMAN-01-51 [↑](#footnote-ref-161)
161. such as Manufuture, Cecimo, Orgalim and others. [↑](#footnote-ref-162)
162. <https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/industry-50_en> [↑](#footnote-ref-163)
163. As relevant, including the projects resulting from HORIZON-CL4-2021-HUMAN-01-26, HORIZON-CL4-2023-HUMAN-01-21/22 and HORIZON-CL4-2023-HUMAN-01-51 [↑](#footnote-ref-164)
164. such as Manufuture, Cecimo, Orgalim and others. [↑](#footnote-ref-165)
165. <https://europa.eu/new-european-bauhaus/index_en> [↑](#footnote-ref-166)
166. <https://jpi-urbaneurope.eu/project/cities-of-making/> [↑](#footnote-ref-167)
167. Ref. [↑](#footnote-ref-168)
168. Such us ISO, IEC, ISO/IEC JTC1, ITU-T, 3GPP, IETF, OneM2M, W3C, OASIS, IEEE (list non eshaustive) [↑](#footnote-ref-169)
169. Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning\_fair\_into\_reality\_1.pdf [↑](#footnote-ref-170)