EN

Horizon Europe

Work Programme 2023-2024

7. Digital, Industry and Space

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Introduction

Progress in digital and industrial technologies, including in space, shapes all sectors of the economy and society. They transform the way industry develops, create new products and services, and are central to any sustainable future. The COVID-19 pandemic, the war against Ukraine and other disruptions have shown the need to strengthen the industrial base of the European Union and the Associated Countries, enhancing its resilience and flexibility both in terms of technologies and supply chains, so as to reduce strategic dependencies on third countries. They have also reinforced the need to address key societal challenges like sustainability or inclusiveness. In a globalised world of heightened uncertainties and volatile geopolitical interests, what is at stake is not only Europe's prosperity and economic competitiveness, but also its ability to have access to critical raw materials, technologies and services that are safe and secure for industry as a whole. This is not about protectionism. This is about upholding EU's strategic interests and guaranteeing security of supply.

As Europe gears up for a more resilient, green, and digital recovery, the EU needs to maintain a strong industrial and technology presence in key parts of digital and other supply chains, in industrial ecosystems while safeguarding its ability to access and operate safely in space. This is critical not only to be able to compete globally, but also to protect its citizens, deliver services and products of the highest quality, and preserve its values and socio-economic model. Europe must develop and deploy technologies and reshape its industries and services towards a new reality, ensuring that industry can become the accelerator and enabler of this necessary change. Therefore the European Commission, in 'Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery',[1] supported the European Green Deal and the Circular Economy Action Plan, alongside the digital strategies 'Shaping Europe's Digital Future', 'Data', 'Artificial Intelligence' White Paper, Digital Decade Communication and 'Space Strategy for Europe'.

The twin green and digital transition is just at its beginning. Major opportunities lie ahead to position the European Union as a technology and industrial leader of this transition. The vision behind the proposed investments under Cluster 'Digital, Industry and Space' is to shape competitive and trusted technologies for a European Union industry with global leadership in key areas; to enable production and consumption respecting the boundaries of our planet; and to maximise the benefits for all parts of society in the variety of social, economic and territorial contexts in Europe.

Horizon Europe is the research and innovation support programme in a system of European and national funding programmes that share policy objectives. Through the programme, special attention will be given to ensuring cooperation between universities, scientific communities and industry, including small and medium enterprises, and citizens and their representatives, in order to bridge gaps between territories, generations and regional cultures, especially caring for the needs of the young in shaping Europe's future. In this context,

[1] 'Updating the 2020 New Industrial Strategy: Building a stronger Single Market for Europe's recovery', COM(2021)350 final

applicants should consider and actively seek synergies with, and where appropriate possibilities for further funding from, other R&I-relevant EU, national or regional programmes[2] (such as ERDF, ESF+, JTF, EMFF, EAFRD, Innovation Fund, InvestEU and the EU's external action instruments), as well as private funds or financial instruments.

The ERDF focuses amongst others on the development and strengthening of regional and local research and innovation ecosystems and smart economic transformation, in line with regional/national smart specialisation strategies. It can support investment in research infrastructure, activities for applied research and innovation, including industrial research, experimental development and feasibility studies, building research and innovation capacities and uptake of advanced technologies and roll-out of innovative solutions from the Framework Programmes for research and innovation through the ERDF.

Furthermore, applicants are encouraged to take advantage of synergies with the Euratom Research and Training Programme that supports inter alia research on materials, circular economy, digitalisation, energy-intensive industries and artificial intelligence (see details in the Euratom Work Programme 2023-25).

The EU's Recovery and Resilience Facility (RRF) aims at financing projects that directly tackle the economic and social impacts from the Coronavirus crisis and support the green and digital transition. For project ideas that directly contribute to these objectives and that have a strong focus in one member state it is advisable to check access to the RRF for a fast and targeted support.

Actions under this cluster will support key enabling technologies that are strategically important for Europe's industrial future, and deliver on the following six expected impacts in the Strategic Plan, through matching destinations in this Work Programme:

- Global leadership in clean and climate-neutral industrial value chains, circular economy and climate-neutral 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.

- 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 circular economy.

[2] The European Commission published guidance on synergies in July 2022: https://research-and-innovation.ec.europa.eu/news/all-research-and-innovation-news/synergies-guidance-out-2022-07-06_en

- Sovereignty in digital technologies and in future emerging enabling technologies by strengthening European capacities in key parts of digital and future supply chains, allowing agile responses to urgent needs, and by investing in early discovery and industrial uptake of new technologies.

- Globally attractive, secure and dynamic data-agile economy by developing and enabling the uptake of the next-generation computing and data technologies and infrastructures (including space infrastructure and data), enabling the European single market for data with the corresponding data spaces and a trustworthy artificial intelligence ecosystem.

- Open strategic autonomy in conceiving, developing, deploying and using global space-based infrastructures, services, applications and data, including by reinforcing the EU's independent capacity to access space, securing the autonomy of supply for critical technologies and equipment, and fostering the EU's space sector's competitiveness.

- A human-centred and ethical development of digital and industrial technologies, through a two-way engagement in the development of technologies, empowering end-users and workers, and supporting social innovation.

Destination 1: Climate neutral, Circular and Digitised Production

This destination will directly support the following Key Strategic Orientations (KSOs), as outlined in the Strategic Plan:[3]

- KSO C, '**Making Europe the first digitally led circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems.'
- KSO A, '**Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations.'
- KSO D, '**Creating a more resilient, inclusive and democratic European society,** prepared and responsive to threats and disasters, addressing inequalities and providing high-quality health care, and empowering all citizens to act in the green and digital transitions.'

Proposals for topics under this Destination should set out a credible pathway to the following expected impact of Cluster 4:

Global leadership in clean, climate-neutral and resilient industrial value chains, circular economy and climate-neutral and human-centric digital systems and infrastructures, 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 European Union and Associated Countries on track for achieving climate neutrality of the industrial sector by 2050, while also reducing other polluting emissions, and for speeding up Europe's independence from Russian fossil fuels, in line with the REPowerEU Plan, by means of cleaner, more efficient and more sustainable industrial processes.

The speed and scale of the twin green and digital transitions has accelerated, and significant opportunities lie ahead to position the European Union and Associated Countries as a technological and industrial leader of this transition, building on their world class R&I capacities and industrial base. Industrial ecosystems will not only need to develop, but also deploy technologies and reshape their goods and services towards a new reality, ensuring that industry can become the accelerator and enabler of the twin green and digital transition. It will also enhance the Union's open strategic autonomy with regard to the underlying technologies.

[3] Whilst Cluster 4 addresses KSOs A, C and D, in addition KSO B is becoming increasingly important, given the role of the industry highlighted in the zero-pollution action plan.

To achieve these goals, the activities in this Destination are complementary to those in Destination 'Increased Autonomy in Key Strategic Value Chains for Resilient Industry'.

The most relevant policies of the European Commission on this front are:

- The European Industrial Strategy of March 2020, and in particular the Update of May 2021: there is now a renewed momentum in the EU to tackle its strategic dependencies as well as to boost its resilience across key strategic areas. The Covid-19 crisis revealed the importance of improving production response and preparedness of EU industry, in support of its long-term competitiveness.

- The Digital Decade of March 2021, where the Commission presented a vision, targets and avenues for a successful digital transformation of Europe by 2030.

- The Circular Economy Action Plan of March 2020 announced initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented and the resources used are kept in the EU economy for as long as possible.

- The Fit for 55 Package of July 2021, delivering the EU's 2030 Climate Target on the way to climate neutrality, given the process industries' 20% share of global greenhouse gas emissions.

- The Zero Pollution Action Plan of May 2021 addresses both pollution and waste, where research needs could be tackled and is particularly relevant to advanced materials and the process industries, as well as to the manufacturing industry.

The topics serving the objectives of this destination are structured as follows:

- **Manufacturing Industry**

The implementation of the Green Deal has major repercussions for manufacturing. Products and related value chains need to be made circular, carbon-neutral and regenerative – in other words, industry has to make positive contributions to the environment and to society, and offer a negative carbon footprint for future products. Manufacturing is expected to be a key driver in this transformation of industry. Current challenges addressed in this work programme include bio-intelligent manufacturing; high-precision and complex-product manufacturing; circularity and remanufacturing; collaborative distributed manufacturing and business models close to the customers, including Manufacturing as a Service, to enable the evolution from the 'smart factory' to the 'smart value network'.

This industrial revolution should not be to the detriment of workers. The lack of appropriate skills in manufacturing is becoming a concern in many sectors, opening the opportunity for the use of breakthrough innovative technologies to make manufacturing jobs more attractive; and more broadly to ensure that manufacturing provides prosperity beyond jobs, while respecting planetary boundaries.

- **A new way to build**, accelerating disruptive change in construction

The construction industry needs to improve its productivity and competitiveness, and upskill its workforce. Its transition pathway depends on greater digitalisation, resilience and resource efficiency across the board. This need has been heightened by recent rising demand following the pandemic, pressure to maintain and repair works and to address hazardous substances.

- **Energy efficient and climate neutral process industries**

From the R&I perspective, climate neutrality by 2050 should be the starting point for any action paving the way to a regenerative industrial transformation. The International Panel on Climate Change (IPCC) report on climate mitigation, released in April 2022,[4] points out that the goal of net-zero GHG emissions for industry is challenging but possible. It will need coordinated action throughout value chains to promote all mitigation options, including energy and materials efficiency, circular material flows, as well as abatement technologies and transformational changes in production processes.

In this context, the process industries' climate neutrality goal is strongly related to the objectives of becoming independent on fossil fuel and fossil fuel imports. To reach these objectives, production processes need to be energy efficient, implying advanced digitisation; renewable energies need to be integrated via electrifications or use of hydrogen; and abatement technologies including CCU for processes that are hard to decarbonise need to be further developed.

This Work Programme refers to the operational objectives of the Processes4Planet partnership, found in the respective Memorandum of Understanding.[5]

- **Circularity and Zero Pollution in process industries**

Energy-intensive industries need to embrace the circular economy and restorative feedback loops, not as an afterthought but as a key pillar of the design of entire value chains. In this context the Chemicals Strategy for Sustainability, which aims to better protect citizens and the environment whilst boosting the innovation for safe and sustainable chemicals, and its related Strategic Research and innovation agenda are also key. Energy-intensive industries need to commit to engage in Hubs for Circularity and to adopt new collaborative circular business models. There is also a clear space to increase the circularity of industrial wastewater, in symbiosis with urban wastewater, recycling a much higher share of the water, including from the municipal sector to industry and valorising more components in the wastewater.

The **Hubs for Circularity (H4C)** will be a key instrument to advance the research and innovation agenda of European industries towards the Green Deal's objectives. The H4Cs will implement a collection of industrial -urban symbiosis and circularity technologies at scale, which will lead to first-of-a-kind, lighthouse demonstrator plants of (near) commercial size

[4] IPCC report "Mitigation of Climate Change', April 2022

[5] http://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/c_2021_4113_f1_annex_en_v3_p1_1213806.pdf

implementing industrial symbiosis and/or urban industrial symbiosis. Starting from existing industry cluster or heavy industrialized urban areas, 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 involving all stakeholders (Industry, SMEs, local authorities, educational institutions and civil society). It is a new way to re-imagine the whole value chain in a cross-sectorial and collaborative way exploiting synergies and anchoring in the local ecosystem to optimize the incoming resources including investments. It is about building on creativity, digital tools, AI, and breakthrough technologies for implementing cost-optimal pathways and new value chains for the engineering of a net-zero circular economy.

Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by demonstrating hubs for circularity (H4Cs) concepts[6], 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).

- **Clean Steel**

Related to the objectives for energy-intensive industries in general, the steel industry will be enabled to reduce its GHG emissions to the Fit for 55 targets, in particular contributing to fulfilling the new obligations foreseen in the revised ETS Directive to prepare for transition to climate neutrality and to take new pathways towards Circular Economy concepts.

Business cases and exploitation strategies for industrialisation: This section applies only to those topics in this Destination, for which proposals should demonstrate the expected impact by including a *business case and exploitation strategy for industrialisation*.

The *business case* should demonstrate the expected impact of the proposal in terms of enhanced market opportunities for the participants and deployment in the EU, in the short to medium term. It should describe the targeted market(s); estimated market size in the EU and globally; user and customer needs; and demonstrate that the solutions will match the market and user needs in a cost-effective manner; and describe the expected market position and competitive advantage.

The *exploitation strategy* should identify obstacles, requirements and necessary actions involved in reaching higher TRLs (Technology Readiness Levels), for example: matching value chains, enhancing product robustness; securing industrial integrators; and user acceptance.

For TRL 7, a credible strategy to achieve future full-scale deployment in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

[6] 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

Where relevant, in the context of **skills**, it is recommended to develop training material to endow workers with the right skillset in order to support the uptake and deployment of new innovative products, services, and processes developed in the different projects. This material should be tested and be scalable, and can potentially be up-scaled through the European Social Fund Plus (ESF+). This will help the European labour force to close the skill gaps in the relevant sectors and occupational groups and improve employment and social levels across the EU and associated countries.

In order to achieve the expected outcomes, for particular topics **international cooperation** is not mandatory but advised with some regions or countries, to get internationally connected and add additional specific expertise and value to the activities.

To achieve wider effects **activities beyond R&I investments** will be needed. Three **co-programmed partnerships** will enhance dissemination, community building and foster spillover effects: **Made in Europe** for the manufacturing industries; and **Processes4Planet** and **Clean Steel** for the energy-intensive industries. Wider activities include the further development of skills and competencies (also via the European Institute of Innovation and Technology, in particular EIT Manufacturing, EIT Digital and EIT Climate-KIC); and the use of financial products under the InvestEU Fund for further commercialisation of R&I outcomes. For the energy-intensive industries in particular, links with the Innovation Fund are important.

Synergies:

For advanced manufacturing in general, synergies are necessary between the Made in Europe Partnership and the Digital Europe Programme, primarily Industrial Data Spaces, Cybersecurity Centres and European Digital Innovation Hubs.

Related to the construction activities, Cluster 5 addresses the energy performance of buildings, under the destination ‘Efficient, sustainable and inclusive energy use’, as well as the Built4People co-programmed partnership for a ‘people-centric sustainable built environment’.

For the energy-intensive industries, there are synergies for energy efficiency and the management of thermal energy in industry in Cluster 5, under ‘Industries in energy transition’; and with the Clean Hydrogen partnership.

As some necessary activities of the energy-intensive industries, such as first-of-a-kind plants, involve deployment beyond TRL 7, synergies with other EU programmes are essential in this context, in particular with the Innovation Fund, with the Life Plus Programme, and with the activities of the EIB. International cooperation in process industries will be strengthened through Mission Innovation 2.0 ‘Net zero Industries’.

Innovation Actions — Legal entities established in China are not eligible to participate in Innovation Actions in any capacity. Please refer to the Annex B of the General Annexes of this Work Programme for further details.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL4-2023-TWIN-TRANSITION-01	334.27		20 Apr 2023
HORIZON-CL4-2023-TWIN-TRANSITION-01-TWO-STAGE	12.00		07 Mar 2023 (First Stage) 05 Oct 2023 (Second Stage)
HORIZON-CL4-2024-TWIN-TRANSITION-01		251.00	07 Feb 2024
HORIZON-CL4-2024-TWIN-TRANSITION-01-TWO-STAGE		37.00	07 Feb 2024 (First Stage) 24 Sep 2024 (Second Stage)
Overall indicative budget	346.27	288.00	

Call - TWIN GREEN AND DIGITAL TRANSITION 2023

HORIZON-CL4-2023-TWIN-TRANSITION-01

Conditions for the Call

Indicative budget(s)[7]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[8]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 20 Apr 2023				
HORIZON-CL4-2023-TWIN-TRANSITION-01-02	IA	48.00 [9]	5.00 to 6.00	8
HORIZON-CL4-2023-TWIN-TRANSITION-01-04	IA	37.60 [10]	5.00 to 7.00	6
HORIZON-CL4-2023-TWIN-TRANSITION-01-07	RIA	32.00 [11]	4.00 to 6.00	6
HORIZON-CL4-2023-TWIN-TRANSITION-01-08	CSA	1.00 [12]	Around 1.00	1
HORIZON-CL4-2023-TWIN-TRANSITION-01-31	RIA	32.00 [13]	8.00 to 10.00	3
HORIZON-CL4-2023-TWIN-TRANSITION-	IA	35.67 [14]	12.00 to	3

7 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

8 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

9 Of which EUR 21.37 million from the 'NGEU' Fund Source.

10 Of which EUR 17.00 million from the 'NGEU' Fund Source.

11 Of which EUR 14.90 million from the 'NGEU' Fund Source.

12 Of which EUR 0.40 million from the 'NGEU' Fund Source.

13 Of which EUR 14.90 million from the 'NGEU' Fund Source.

01-33			15.00	
HORIZON-CL4-2023-TWIN-TRANSITION-01-36	RIA	13.00 [15]	6.00 to 7.00	2
HORIZON-CL4-2023-TWIN-TRANSITION-01-37	IA	40.00 [16]	15.00 to 20.00	2
HORIZON-CL4-2023-TWIN-TRANSITION-01-40	RIA	30.00 [17]	10.00 to 12.00	3
HORIZON-CL4-2023-TWIN-TRANSITION-01-42	RIA	30.00 [18]	10.00 to 12.00	3
HORIZON-CL4-2023-TWIN-TRANSITION-01-43	IA	23.00 [19]	4.00 to 6.00	4
HORIZON-CL4-2023-TWIN-TRANSITION-01-45	RIA	12.00 [20]	3.00 to 6.00	2
Overall indicative budget		334.27		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.

14 Of which EUR 16.30 million from the 'NGEU' Fund Source.
15 Of which EUR 5.86 million from the 'NGEU' Fund Source.
16 Of which EUR 17.93 million from the 'NGEU' Fund Source.
17 Of which EUR 14.15 million from the 'NGEU' Fund Source.
18 Of which EUR 14.15 million from the 'NGEU' Fund Source.
19 Of which EUR 10.50 million from the 'NGEU' Fund Source.
20 Of which EUR 5.60 million from the 'NGEU' Fund Source.

Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Manufacturing Industry

Proposals are invited against the following topic(s):

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 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 48.00 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.
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 two projects in each technology area, provided that the applications attain all thresholds.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training

	Programme of the European Atomic Energy Community (2021-2025). [21]. The funding rate is up to 60% of the eligible costs as a way to increase the contribution of industry to this co-programmed partnership. This funding rate applies to both 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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- High-precision manufacturing and/or manufacturing of products with complex geometries or structures; embedded electronics, optics or photonics; surfaces and surface functionalities; and multi-process manufacturing;
- Highly resilient and flexible production lines, enabling highly customised products across a wide range of markets, and ensuring open strategic autonomy for the manufacturing industry of the Union and Associated Countries.
- Significant reductions in the use of materials, waste, defects and energy consumption, which also lead indirectly to reductions in GHG emissions.
- Fostering the competitiveness of the European manufacturing industry, in general and (*only 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. in terms of geometries, structures, embedded and structural electronics, optics or photonics, micro-, nano- or bio-mimetic features or advanced and composite 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 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:

[21] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Advancement and demonstration of significant improvements in smart production technologies to **manufacture complex products** such as additive manufacturing, multi-process 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, super-polishing, surface texturing, thin film coating, etching and electrochemical machining, handling and assembly processes, 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 should indicate which approach they are targeting.

Proposals may also propose to combine more than one of the above approaches when justified for specific high-tech product. For these cases, proposals should still indicate which of the approaches is the primary/main one.

Proposals are also allowed to combine two of the approaches above, *provided there is added value in such a combined approach. Arbitrary combinations without integration are excluded*.

In all cases, process development will be required to demonstrate and validate the benefits the technologies in flexible and individualised manufacturing processes, minimising waste, defects, energy consumption and emissions; and enabling sustainable, innovative and improved products. The quality of the new products should be validated according to the most advanced metrology capacities, 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, *only provided this brings added value*:

- Use of novel sustainable and smart materials to achieve same or higher technical features in products while reducing environmental impact and waste;

- 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;

- Flexible and collaborative robots and multi-axis machines, to improve their accuracy to high-precision manufacturing;

- Multiscale physics-based models and machine learning/AI methodologies to improve prediction capacity/optimisation in manufacturing, remanufacturing and reuse;
- Management of data;
- Suitable, robust and traceable in-process process and dimension control

Links may be established with relevant cases emerging from the CSA project HORIZON-CL4-2023-RESILIENCE-01-39.

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.

Interoperability for data sharing should be addressed, focusing on open and trustful federated concepts and standards, enabling effective cross-domain data communities, new data-driven markets, and the Digital Product Passport initiative.

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-01-04: Factory-level and value chain approaches for remanufacturing (Made in Europe Partnership) (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 7.00 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 37.60 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- Suitably scaled green and digital technologies supporting remanufacturing, for circular value chains in industrial ecosystems;
- Remanufacturing of both components and products towards full circularity while retaining value or functions of components;
- Skills and education capabilities for remanufacturing.

Scope: Remanufacturing is an industrial process in which at least one change is made to waste products or components affecting their safety, performance, purpose or type. Remanufacturing aims to retain the usefulness of both products and components and is an essential step in achieving full industrial circularity without implying deterioration of the product.

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 focused only on the reuse of raw materials but should be aimed at reusing and upscaling components, valorising them and retaining or upgrading their functionality. Components, products and/or functions can be updated with new technology and improved beyond their initial functionality. Ultimately, remanufacturing is indirectly expected to reduce the level of resource consumption and hence also the level of CO_2-intensity of components.

Proposals should address technologies within specific industrial sectors or across industrial sectors:

- Develop cutting-edge remanufacturing approaches (design, technologies, business cases) and their integration into value chains;
- Demonstrate remanufacturing processes that retain components functionality in at least three user cases;

- The introduction of traceability aspects, quality control and a regulatory validation need to be considered;
- Repurposing of components into a variety of industrial sectors. Introduce flexible production concepts, advanced machinery, smart mechatronics, interactive and collaborative machines, robots and systems enabling efficient factory operation and reconfiguration;
- Consider operational and economic viability while also the environmental impact of the proposed approach.

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. Collaboration with EIT Manufacturing is encouraged, in particular on the development of skills.

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 into account such as the Ecodesign Directive and the forthcoming Sustainable Product Framework (SPI)[22].

Proposals should take into account any relevant international standards (such as the Asset Administration Shell) and activities supported under the Digital Europe programme, e.g. in the area of Manufacturing Data Spaces and the Digital Product Passport initiative.

Research must build on existing standards or contribute to future standardisation. Interoperability for data sharing must be addressed, leveraging on existing ontologies and metadata and though the implementation of the FAIR data principles.[23]

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.

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

HORIZON-CL4-2023-TWIN-TRANSITION-01-07: Achieving resiliency in value networks through modelling and Manufacturing as a Service (Made in Europe Partnership) (RIA)

Specific conditions

[22] https://ec.europa.eu/environment/publications/proposal-ecodesign-sustainable-products-regulation_en
[23] Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning_fair_into_reality_1.pdf

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 32.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- Availability of reliable models, simulators, digital twins, decision making and planning 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 logistics and production to varying external conditions, improving the resilience of the industrial systems and value chains, and the sustainability of the entire production process.
- Smart manufacturing networks that are resilient and capable of self-adaptation in response to external threats.

Scope: Manufacturing as a Service (MaaS) is a distributed system of production in which resources (including data and software) are offered as services, allowing manufacturers to access distributed providers to implement their manufacturing processes. This topic approaches MaaS from the value network perspective, aiming at exploiting the intrinsic flexibility and resilience provided by the possibility to use distributed and programmable resources on demand, under real-world conditions characterised by high volatility of the supply, the market requirements and the external constraints.

Proposals should develop:

- Realistic actionable 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.

- Solutions that make use of the flexibility of the manufacturing ecosystem to respond to external events, enabling trusted cross organisation real-time data integration / exchange based on standards, and supporting the partial automation of the processes from the confirmation of the order up to the delivery of the product.

Models and simulations should be developed from a human-centred perspective, 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. The potential of a circular approach to address resilience should be considered.

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.

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-CL4-2023-TWIN-TRANSITION-01-08: Foresight and technology transfer for Manufacturing as a Service (Made in Europe Partnership) (CSA)

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 1.00 million.

Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [24].

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 (a) analysis of the best practices to advance circularity, decarbonisation, and sustainability of industrial production in the context of "Manufacturing as a Service" approach, (b) analysis of foreseeable developments and trends, including the potential advantages and disadvantages, regarding distributed Manufacturing as a Service vs. centralised manufacturing, (c) recommendations for an EU manufacturing standardisation strategy focusing specifically on the role of data and (d) 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 (including data and software) are offered as business-to-business services, allowing manufacturers to access distributed providers to implement their manufacturing processes.

Proposals should develop the strategic foresight listed under point 1 involving the manufacturing community at large, including the Manufacturing Data Spaces and the network of European Digital Innovation Hubs, as well as the Open Innovation Test Beds (OITBs).

[24] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Identification of strategies and best practices will take into account the evolving geopolitical context.

The activities will also include an effective dissemination campaign, the organisation of events and workshops to facilitate technology transfer and collaboration. A specific focus should be given to 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".

Energy Intensive Process Industries

Energy-efficient and climate neutral process industries
Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 8.00 and 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 32.00 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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [25].

[25] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link:

Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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:

- Increase the energy efficiency of energy intensive industrial processes by reducing energy use by at least 30% and the process as compared to current state of the art;
- Enable the techno-economic feasibility of novel technologies and processes, validated and demonstrated at suitable scale against state of the art of industrial processes;
- Enable the potential of an increased use of renewable energy;
- Contribute to achieving EU climate neutrality goal and becoming independent from fossil fuel and fossil fuel imports as put forward in the REPowerEU Plan[26].

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 change in the process industries’ energy efficiency, the combination of digital technologies with highly energy efficient process breakthroughs is required.

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 in 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.

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https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[26] COM/2022/230 final

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. Proposals are encouraged to consider 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-CL4-2023-TWIN-TRANSITION-01-33: Electrification of high temperature heating systems (Processes4Planet Partnership) (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 12.00 and 15.00 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 35.67 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. The following exceptions apply: The funding rate is up to 60% of the eligible costs as a way to increase the contribution of industry to this co-programmed partnership. This funding rate applies to both 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: 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 high temperature demand systems in the process industry;

- 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 the process industries to substitute fossil fuels for heating, thereby contributing to the independence from fossil fuel and fossil fuel imports as put forward in the REPowerEU Plan[27];
- Showcase the scalability and the cost efficiency of the proposed solutions;
- Enable the economic viability of the entire unit to compete with the existing state of the art of fossil-based heating systems and increase of 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 for 20% of process industries GHG emissions. The topic focuses on the sustainable electrification of high temperature heating systems, for example, industrial furnaces, kilns and crackers among others. Electrification of these heating systems with renewable electricity could represent a major reduction of the related GHG emissions.

The proposals should:

- Integrate existing highly efficient technologies, e.g., 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.

The inclusion of a GHG avoidance methodology[28] 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. As a project output a

[27] COM/2022/230 final

[28] 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

more elaborated exploitation plan should be developed including preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan and financial model) indicating the possible funding sources to be potentially used (e.g., Innovation Fund, InvestEU, ESIF). Societal and environmental impact and implications for the workplace (such as skills, organisational change) should be outlined.

Research must build on existing standards or contribute to standardisation. Where relevant, 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 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-CL4-2023-TWIN-TRANSITION-01-36: Modelling industry transition to climate neutrality, sustainability and circularity (Processes4Planet partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 7.00 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 13.00 million.
Type of Action	Research and Innovation Actions
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [29].

Expected Outcome: 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. Processes4Planet is about transforming European process industries to make them circular and achieve overall climate neutrality at EU level by 2050,

[29] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

while enhancing their global competitiveness. Modelling capacity and scenarios are needed to chart the pathways towards climate neutrality. 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). They will support EU climate ambitions and, following the International Panel on Climate Change (IPCC) report on climate mitigation recommendations,[30] allow for actions throughout value chains to promote all mitigation options, including energy and materials efficiency, circular material flows, as well as abatement technologies and transformational changes in production processes.

Projects are expected to contribute to the following outcomes:

- Development of a model, enhancement of existing modelling tools [31] towards understanding the pathways for industry, and Energy Intensive Industries in particular, to contribute to EU's climate neutrality;

- Modelling of scenarios of possible pathways of how industry, and Energy Intensive Industries in particular, can become climate neutral according to the following five dimensions: (1) their energy demand and use and energy efficiency, (2) their emissions including process emissions; (3) in use of raw materials, chemicals and water (e.g. via increasing the use of circular approaches and material substitution, also in view of ensuring affordability of industrial products); (4) their production of consumer goods/equipment/construction products (e.g. looking at sustainability of products and embedded carbon – a preliminary approach only); (5) possibility of replacing fossil carbon in materials by more sustainable streams (e.g. recycled carbon from industrial emissions, from waste, sourced from sustainable biomass or directly from the atmosphere[32]);

- Facilitate 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 industry is considered as hard-to-abate sector[33]. 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;

- Set 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;

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30 IPCC report on "Mitigation of Climate Change', April 2022

31 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/

32 Sustainable Carbon Cycles Communication (COM (2021) 800 final

33 compared to buildings sector or power generation

- Enhance the knowledge about climate neutrality pathways for industry 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 in1990 and projections up to 2070 and this for the European Union and Associated Countries altogether and each Member State/country separately as well as for European Economic Area according to the 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;. Considering that these industries link 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 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 proposal should produce first results available for review by the project midterm.

The proposals as a part of its validation and stakeholders' involvement will enable to participate in peer-review processes, scientific conferences and publish in scientific journals and create possibilities for a feedback loop from stakeholders. The modelling capacity 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 internally consistent in their 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.

Proposals should seek cooperation and give input to the Processes4Planet partnership Advisory Committee panels,[34] 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 comparative tools e.g., the Energy and Industry Geography Lab of the Joint Research Centre.

Cooperation with other selected projects under this topic is strongly encouraged.

This topic implements the co-programmed European partnership Processes4Planet.

Circularity and Zero Pollution in process industries
Proposals are invited against the following topic(s):

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 15.00 and 20.00 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 40.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally

[34] Memorandum of Understanding for the Co-programmed European Partnership Processes4Planet (P4Planet), 3. Governance. http://ec.europa.eu/info/sites/default/files/research_and_innovation/funding/documents/c_2021_4113_f1_annex_en_v3_p1_1213806.pdf

	extended by 3 pages.

Expected Outcome: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by demonstrating hubs for circularity (H4Cs) concepts, fostering circularity within and beyond process industries and driving the partnership's innovation portfolio towards "First of a kind" demonstrators so as to de-risk investment for subsequent roll-out. (P4Planet operational objectives 8 and 9).

Projects are expected to contribute to the following outcomes:

- Achieve a step change in circular utilization of resources within the process industries reducing the use of virgin resources (materials, energy, and water) by at least 20% of reduction as compared to current state of the art;
- Citizens living in proximity of heavily industrialized clusters will benefit from a healthier environment through industrial symbiosis by lowering emissions through circular and renewable energy sources;
- Use industrial symbiosis and cross-sectorial cooperation to pave the way for achieving the EU Green Deal and "Fit for 55" package objectives: providing recommendations for optimized regional framework conditions by highlighting barriers and suitable innovation-oriented policies.

The targets above are meant to be achieved collectively by the region/area where the demonstration is located, not only by consortium members.

Scope: An industrial symbiosis, near commercial scale demonstrator, hub should integrate infrastructures (e.g., industrial waste, by-product and water management infrastructure, fluid flow networks, digital infrastructure), and energy networks and grids (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, integration of e renewable energies, use of hydrogen as an energy carrier, and/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.

Proposals should address the following aspects:

- Develop systemic solutions leading to a Hub for Circularity (H4C) for near zero emissions as described above;
- (Co-)design and adapt existing processes to integrate new solutions (energy and mass flow coupling, infrastructure, and logistics) and to exploit new synergies between sectors;

- Use digital modelling tools and sensing systems as a basis for dynamic resource management, including information on quantities and characterisation 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, it might not be in the same location as the demonstrator and serve the needs of multiple hubs;

- Deploy one Industrial symbiosis near commercial scale demonstrator using renewables as energy sources, including renewable hydrogen as energy carrier, to achieve at least 30% CO2 reduction when deployed at full scale at the Hub for Circularity and close environment level. This should balance the overall energy consumption with efficiency gains for the Hub for Circularity of at least 10%, including utilisation through cascading heat recovery, smart grid, and digitalised 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;

- Plan in detail the replication and adaption of the concept, including the simulation and the business case and exploitation strategy of the First of a Kind hubs, in two to three alternative locations in close cooperation with the relevant local actors;

- Consider when applicable the co-development of industrial decarbonization strategies with heat-nets, i.e., based on a socio-economic optimum in the cascading re-use of waste heat and the supply low temperature process heat to the surrounding ecosystem;

- Use established reporting methodologies for the assessment of industrial symbiosis activities and exchanges including Symbiosis Readiness Levels (SRLs) and best practices established by the H4C European Community of Practice (ECoP). In addition, interact with the ECoP for support, best practice and knowledge exchange on technological and non-technological issue;

- Include a plan to extend the hub to additional parties who also should benefit and multiply the local/regional synergies in the co-implementation of the identified innovations and solutions within the next five years;

- Implement a social innovation action involving at least one of the local community actors and, additional actions to facilitate relations and engage with e local community actors e.g., exchanging knowledge with the educational establishments and developing flexible learning resources.

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

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal. Research must build on existing standards or contribute to standardisation. 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 as well as building on existing projects is strongly encouraged (see also Industrial Symbiosis[35] and Trends[36] 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-01-40: Sustainable and efficient industrial water consumption: through energy and solute recovery (Processes4Planet partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 10.00 and 12.00 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 30.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

Expected Outcome: 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).

[35] https://op.europa.eu/en/publication-detail/-/publication/f26dfd11-6288-11ea-b735-01aa75ed71a1
[36] https://www.aspire2050.eu/sites/default/files/pressoffice/publication/trends_report_2020.pdf

Projects are expected to contribute to the following outcomes:

- Demonstrate sustainable industrial water consumption based on new technologies for energy and solute recovery;
- Enable full circular use of water in process industry thus reducing industry dependence and utilisation of fresh water;
- Enable the techno-economic feasibility of the processes and technologies for water treatment and recycling particularly when combined with energy and waste reduction strategies to compete with the existing state of the art;
- Maximise the recovery of substances and energy present in the wastewater streams;
- Demonstrate contribution to EU climate neutrality goal.

Scope: Wastewater discharge from industry has decreased over decades. This is a consequence of 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. Amongst process industries, pulp and paper, steel and chemicals have high wastewater discharges. The Processes4Planet target is to demonstrate the potential for 90% of wastewater reuse by 2030. 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 wastewater 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 digital 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).

The proposals should include energy efficiency, techno-economic and life-cycle assessments considering the overall process. 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 consider outcomes from the Horizon 2020 topic CE-SPIRE-07-2020: Preserving fresh water: recycling industrial waters industry.

In addition, the topic could explore synergies with the Ocean and Waters and the Soil missions.

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 10.00 and 12.00 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 30.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the

	Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [37].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: 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 as those produced using primary resources and allowing production without quality restriction;
- Increase the use of secondary resources in the process industry leading to significant increase in resource efficiency across the value chain and subsequent reduction of 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;
- The proposed technologies should contribute to the matching of supply-versus-demand of feedstock at the level of quality constraints (removal of impurities or wrong matrices, concentration etc.);
- Foster data sharing, and FAIR (Findability, Accessibility, Interoperability and Reusability) 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.

[37] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Scope: Currently only 12% of the material resources used in the European process industry are recycled and recovered materials and these are mostly down cycled 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 the following aspects:

- 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, detection and removal additives in the secondary resources stream;
- Take due account of logistic aspects such as production planning, risk assessment and management or zero defect at supply chain level;
- 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. Where relevant 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. Particular attention should be given to the cooperation with existing initiatives that have developed education and skills activities and outcomes in this area.

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 (plastic wastes and composites,[38] which were the subject of the WP 2021-22,[39] and steel scrap implemented as part of the Clean Steel partnership are excluded).

This topic implements the co-programmed European partnership Processes4Planet.

Clean Steel
Proposals are invited against the following topic(s):

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)

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 23.00 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.
Procedure	The procedure is described in General Annex F. The following

[38] The following are not composites and therefore are within the scope of this topic: Main materials in recyclates that are contaminated by minor components as heritage from former uses in composites (e.g. other polymers, resins, …), plastics (e.g. additives), construction materials (e.g. minerals with organics or metals), etc. whereas the contamination hinders the full qualitative recycling of the main material.

[39] HORIZON-CL4-2021-TWIN-TRANSITION-01-17: Plastic waste as a circular carbon feedstock for industry (Processes4Planet Partnership) (IA); HORIZON-CL4-2021-RESILIENCE-01-01: Ensuring circularity of composite materials (Processes4Planet Partnership) (RIA)

	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.
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 as a way to increase the contribution of industry to this co-programmed partnership. This funding rate applies to both 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: Projects outcomes will enable achieving the objectives of the Clean Steel Partnership (CSP) by contributing to one of 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-CO_2 production site (related to the CSP Building Block (BB) 3: Melting of pre-reduced and reduced ore, scrap, and iron-rich low-value residues for clean steel production[40]);

2. Curtailing CO_2 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. 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 the CSP 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 related to the above point 1 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 CO_2 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-CO_2 production

[40] https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf

site. 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

Projects related to the above point 2 are expected to contribute 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 the CO_2 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-CO_2 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 H_2, biogas, CO_2-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 CO_2 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 CO_2 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 or biogas or O_2 and H_2 (H_2-rich gases or pure H_2) 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-CL4-2023-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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 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 12.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

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: 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 hydrometallurgical / biohydrometallurgical units. Such knowledge and results should support the valorisation of 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 CO_2 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), 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 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; all focused on 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 CO_2 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.

Call - TWIN GREEN AND DIGITAL TRANSITION 2023 TWO STAGE

HORIZON-CL4-2023-TWIN-TRANSITION-01-TWO-STAGE

Conditions for the Call

Indicative budget(s)[41]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[42]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 07 Mar 2023 (First Stage), 05 Oct 2023 (Second Stage)				
HORIZON-CL4-2023-TWIN-TRANSITION-01-11	RIA	12.00	5.00 to 6.00	2
Overall indicative budget		12.00		

General conditions relating to this call

[41] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[42] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

A New Way to Build, accelerating disruptive change in construction

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 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 12.00 million.
Type of Action	Research and Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
Eligibility	The conditions are described in General Annex B. The following

conditions	exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [43].

Expected Outcome:

- 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, thus reducing the resource- and energy-intensity of the construction sector
- 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,

[43] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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 should therefore aim to foster selective deconstruction, separation of hazardous materials, sorting and high-quality recycling. They 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.
- 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.

- Present a strategy for skills development, associating social partners where relevant, integrating SSH aspects and including relevant tools such as MOOCs (massive open online courses).

- 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.

- Seek to integrate insights from social sciences and humanities to maximise economic and social impact.

Call - TWIN GREEN AND DIGITAL TRANSITION 2024

HORIZON-CL4-2024-TWIN-TRANSITION-01

Conditions for the Call

Indicative budget(s)[44]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[45]	Indicative number of projects expected to be funded
		2024		
Opening: 19 Sep 2023 Deadline(s): 07 Feb 2024				
HORIZON-CL4-2024-TWIN-TRANSITION-01-03	RIA	35.00	5.00 to 7.00	5
HORIZON-CL4-2024-TWIN-TRANSITION-01-05	RIA	36.00	4.00 to 6.00	6
HORIZON-CL4-2024-TWIN-TRANSITION-01-32	IA	30.00	10.00 to 15.00	2

[44] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[45] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

HORIZON-CL4-2024-TWIN-TRANSITION-01-34	RIA	20.00	8.00 to 10.00	2
HORIZON-CL4-2024-TWIN-TRANSITION-01-35	IA	30.00	10.00 to 15.00	2
HORIZON-CL4-2024-TWIN-TRANSITION-01-38	IA	40.00	15.00 to 20.00	2
HORIZON-CL4-2024-TWIN-TRANSITION-01-41	RIA	30.00	10.00 to 12.00	3
HORIZON-CL4-2024-TWIN-TRANSITION-01-44	IA	10.00	3.00 to 5.00	2
HORIZON-CL4-2024-TWIN-TRANSITION-01-46	RIA	20.00	3.00 to 5.00	4
Overall indicative budget		251.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Manufacturing Industry

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-TWIN-TRANSITION-01-03: Manufacturing as a Service: Technologies for customised, flexible, and decentralised production on demand (Made in Europe Partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 7.00 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 35.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [46].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome:

[46] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Easy access to flexible and decentralised manufacturing and remanufacturing capacities, especially for SMEs, reducing the required investments for manufacturers while enabling them to use more sustainable and circular facilities.

- Availability of automation, emerging and digital technologies for the servitisation of manufacturing assets assuring optimal performance, fast reconfiguration and upgrade with minimal downtime, remote monitoring and predictive maintenance via trusted, secure and interoperable cross-company data exchange.

- Improved value chain integration through the availability of technologies and models for securely exchanging and leveraging life-cycle data of servitised manufacturing assets, also in view of the reuse or recycle of assets, components, and materials.

Scope: Manufacturing as a Service (MaaS) is a distributed system of production in which resources (including data and software) are offered as services, allowing manufacturers to access distributed providers to implement their manufacturing processes. The servitisation of manufacturing resources contributes significantly to production flexibility and responsiveness, enabling production on demand for many product categories. Suppliers of manufacturing systems and of integration technologies design and offer interoperable services in close partnership with manufacturing companies, while other providers in the value chain can offer additional services. Secure, real-time data exchange between the companies involved enables quick response times.

This topic aims at further developing and integrating the technologies needed for the successful implementation of MaaS 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 and exploiting unused production capacities, also by rapid re-purposing of manufacturing machines. The objective will be achieved through platforms for fast data exchange and seamless, data-driven, standards-based automation of inter-company processes beyond the factory boundaries.

Integration with digital design, development of design libraries and workflow templates, and advanced technologies such as digital twins, real-time AI-based decision support systems, and next-generation Manufacturing Execution Systems should also be considered where appropriate, with the objective to optimise the entire life-cycle of the product in terms of circularity, sustainability and reusability, using product life cycle assessments whenever appropriate.

Interoperability is a core requirement for MaaS; for this reason, research will build on existing standards or contribute to standardization where relevant, taking also into account the contributions of upcoming EU initiatives like the Digital Product Passport or the Manufacturing Data Spaces.

Results should be demonstrated through at least two realistic use cases, based on different supply chains or industry sectors.

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.

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

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 36.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- Assessing the environmental impact of their products, including the flow of products after their use to reduce product and raw material waste with the support of digital technologies;
- Achieving a considerable net reduction of the environmental impact through the use of innovative modelling and simulation software that allows transport and manufacture monitoring, ultimately driving the decarbonisation of the manufacturing industry;

- Facilitating 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;

- Removing barriers in the uptake of the digital tools from the market will be addressed and the workforce will be empowered through new skills.

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

Data pooling and sharing among sectors and across the whole value chain, as well as the use of external environmental impact data such as LCA-data, would facilitate recycling and remanufacturing, by modelling and monitoring the life cycle of products and components. Such data pooling would enable a better insight into the environmental footprint, including the CO_2-footprint, 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 Framework (SPI) [47] 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 consumers, therefore the manufacturers should be prepared for its implementation.

The transition to the circular manufacturing requires a new mindset and expertise. 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. The workforce should be engaged in the realization of circular approaches and the new manufacturing technologies.

Proposals should cover all of the following aspects:

- Develop new approaches of Artificial Intelligence to forecasts the environmental impact, also considering the quantity and state of products after their use;

- Develop innovative simulation and modelling software or built on existing solutions fostering new manufacturing capabilities 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 environmental impact. Additional ecological impacts arising from the use of the modelling or simulation software should be considered;

- Develop digital platforms/ tools build on existing interoperability architectures (such as the Asset Administration Shell), that will enable the manufacturers to implement the

[47] https://ec.europa.eu/environment/publications/proposal-ecodesign-sustainable-products-regulation_en

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;

- Enhance the human involvement in the development of the circularity aspects and new technologies.

Links may be established with relevant cases emerging from the CSA project HORIZON-CL4-2023-RESILIENCE-01-39.

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

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

Proposals should take into account relevant international standards and 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.[48]

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. Collaboration with EIT Manufacturing is encouraged, in particular on the development of skills.

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

Energy Intensive Process Industries

Energy-efficient and climate neutral process industries
Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 10.00 and 15.00 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 30.00 million.

[48] Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning_fair_into_reality_1.pdf

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.

Expected Outcome: 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 energy efficiency and reduce investment cost of high temperature installations;
- Demonstrate a substantial increase in flexibility of the processes;
- Contribute to achieving EU Climate neutrality goal and becoming independent from fossil fuel and fossil fuel imports as put forward in the REPowerEU Plan[49];
- Enable the increase of the competitiveness and resilience of the European process industry.

Scope: More than 60%[50] of the overall energy used in the process industry is process heating. The topic focuses on highly process-integrated technologies that allow heat recovery and use of 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 (150-250 °C) applications for large thermal capacity (~1-20 MW), 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 into 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, where necessary, the use of advanced materials in the process development;

[49] COM/2022/230 final

[50] https://www.sintef.no/globalassets/sintef-energi/industrial-heat-pump-whitepaper/2020-07-10-whitepaper-ihp-a4.pdf

- Demonstrate the decrease of energy intensity of output level (intermediate, final product).

The inclusion of a GHG avoidance methodology[51] is recommended and should provide detailed description of baselines and projected reductions.

The heat power generation is out of the scope of this topic. The proposals should include energy efficiency, techno-economic and life-cycle assessments considering the overall process.

Proposals submitted under this topic should include a sound business case and strong exploitation strategy, as outlined in the introduction to this Destination. As a project output a more elaborated exploitation plan should be developed including preliminary plans for scalability, commercialisation and deployment (feasibility study, business plan and financial model). This should also include the assessment of possible societal and environmental impact and implications for the workplace (such as skills, organisational change).

Research must build on existing standards or contribute to standardisation. Where relevant, 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.

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 8.00 and 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 20.00 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.
Exceptional page limits to	In order to include a business case and exploitation strategy,

[51] 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

proposals/applications	the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by developing new processes integrating renewable hydrogen that can replace 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:

- Enable the technical and economic feasibility of innovative production routes using hydrogen as feedstock[52] demonstrated and validated at suitable scale against current state of art of industrial processes;
- Enable the efficient use and integration of hydrogen as a feedstock in innovative industry processes, considering also fluctuation of availability;
- Support the increased utilisation of renewable energy sources combined with digital technologies in the process industries, thereby contributing to the independency on fossil fuel and fossil fuel imports as put forward in the REPowerEU Plan[53];
- Contribute to EU Climate neutrality goal 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. Hydrogen is thus an important enabler for meeting 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.

Currently, 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). The proposals under this topic should:

- Develop innovative production routes using hydrogen as feedstock;

[52] The production as well as the use of hydrogen as energy carrier is excluded from the scope of the topic.
[53] COM/2022/230 final

- Evaluate the efficient integration of the new production process into the processing line, including downstream and upstream;
- Design production process coupled/integrated with renewable hydrogen by making the best use of simulation, modelling and IT tools;
- Include energy efficiency, techno-economic and life-cycle assessments considering 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.

The use of hydrogen as feedstock to produce fuels is out of the scope of this topic. Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. Societal and environmental impact and implications for the workplace (such as skills, organisational change) should be outlined.

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.

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 10.00 and 15.00 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 30.00 million.
Type of Action	Innovation Actions
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. The following exceptions apply: The funding rate is up to 60% of the eligible costs as a way to increase the contribution of industry to this co-programmed partnership. This funding rate applies to both 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: 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; that will drive the partnership's innovation portfolio towards first of a kind demonstrator and 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 industry point sources and utilization of 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 state of the art production of the same or equivalent products (e.g., fossil-based production of chemicals and materials);
- Prove the efficient integration and use of renewable energy sources, and where relevant account for their intermittency and the possibility to offer demand-response flexibility;
- Enable the increase of the competitiveness and resilience of the European process industry.

Scope: The proposals submitted under this topic are expected to demonstrate the economic viability of the efficient capture and utilisation of CO/CO2 streams from point sources (e.g., large and medium industrial installations such as steel, cement, refining and chemical plants) converting the streams 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 scale demonstrators[54] 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[55] and fit for purpose purification approaches[56] while ensuring the maximum process efficiency;

[54] at a scale that allows to take economical and technical decisions for a First of a kind (FOAK) plant.

[55] Including, for example, use of waste heat in scrubbers, increased mass transport in intensified scrubbers, electrified systems with promising novel materials and equipment design. These are just illustrative examples.

[56] Including, for example, advanced membranes and environmentally friendly absorbents for cleaning formulations, compression, drying, concentration, Pressure Swing Adsorption etc.). These are just illustrative examples.

- Demonstrate the cost efficient environmentally friendly conversion of CO/CO_2 into chemicals and materials including any relevant auxiliary required for the process (such the formulation of reliable catalyst at the required scale) and 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 fully integrated capture and utilization systems, including the optimization of materials, process interfaces, 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 optimising CAPEX and reducing CO2 abatement costs. This should be demonstrated through at least one realistic use case with demonstrable economic return developed in closed cooperation between CO2 industrial emitters, users and technology providers.

The inclusion of a GHG avoidance methodology[57] 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. As a project output a more elaborated exploitation plan should be developed including preliminary plans for scalability, commercialisation, and deployment (feasibility study, business plan and financial model) 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.

Where synergies are possible with projects from topic HORIZON-CL5-2024-D3-02-11, cooperation activities are encouraged.

This topic implements the co-programmed European partnership Processes4Planet.

Circularity and Zero Pollution in process industries
Proposals are invited against the following topic(s):

[57] 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

HORIZON-CL4-2024-TWIN-TRANSITION-01-38: Hubs for circularity for industrialised urban peripheral areas (Processes4Planet partnership) (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 15.00 and 20.00 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 40.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: Projects outcomes will enable achievement of the objectives of Processes4Planet partnership by demonstrating hubs for circularity (H4Cs) concepts, 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 near commercial scale environment through systemic resource recovery as alternative material feedstock; a decrease of GHG emissions is also expected by explicitly addressing the reduced flow of goods (due to geographical proximity);
- Reduce the freshwater consumption of the urban area by 50%, and re-use 90% of the solid waste generated by the water treatment;

- 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;

- Use urban/industrial symbiosis and cross-sectorial cooperation to pave the way for achieving the EU Green Deal and "Fit for 55" package objectives: providing recommendations for optimized regional framework conditions by highlighting barriers and suitable innovation-oriented policies and looking for possible synergies with the cities selected by the Cities Mission[58] .

Scope: Urban areas with high volumes of waste (household and end of life consumer waste) should closely interact with adjacent industries to jointly minimize their CO2 footprint and improve their waste management, 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 for the deployment of 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[59], by systemically re-integrating the flow of urban wastes in process industries and, where applicable downstream in manufacturing, construction, and other industries. 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);

- Proposals can address either materials, water or energy, or a combination of those. Management and processing of secondary resource streams through e.g., collection, disassembly, sorting, purification, concentration, recycling (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. The remaining non-recyclable fractions will be used to optimal energy recovery;

- Digital tool, recycling and sensor-based waste sorting, 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

[58] Not mandatory.
[59] at a scale that allows to take economical and technical decisions for a First of a kind (FOAK) plant.

tagging/matrix for complex consumer products and innovative approach to end-of life materials;

- Establish IT infrastructures and tools that provide a secure basis for the integrated management and the preservation of confidentiality of sensitive data, it might not be in the same location as the demonstrator and serve the needs of multiple hubs;

- Consider when applicable the co-development of industrial decarbonization strategies with urban district heating networks, i.e., based on a socio-economic optimum in the cascading re-use of waste heat and using the district heating network to supply low temperature process heat[60];

- Use established reporting methodologies for the assessment of industrial symbiosis activities and exchanges, including Symbiosis Readiness Levels (SRLs) and best practices established by the European H4C Community of Practice (ECoP). In addition, interact with the ECoP for support, best practice and knowledge exchange on technological and non-technological issues;

- Plan in detail the replication and adaption of the concept, including the simulation and the business case and exploitation strategy of the First of a Kind hubs, in two to three alternative locations in close cooperation with the relevant local actors. The replication cases should be part of the proposal. 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;

- Implement a social innovation action involving at least one of the local community actors and, additional actions to facilitate relations and to involve the local community actors e.g., exchanging knowledge with the educational establishments and developing flexible learning resources;

- Include a plan to extend the hub to additional players parties (especially waste management and associations, new market entries and other relevant stakeholders) who also should benefit and multiply the local/regional synergies in the co-implementation of the identified innovations and solutions within the next five years.

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

[60] Waste incineration coupled with district heating is excluded.

Relevant indicators and metrics, with baseline values, should be stated clearly in the proposal. Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

Clustering and cooperation with other selected projects under this topic and other relevant topics in Horizon Europe (e.g., HORIZON-CL4-2023-TWIN-TRANSITION-01-42 or HORIZON-CL4-2023-RESILIENCE-01-05), 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 of March 2020[61]).

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 10.00 and 12.00 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 30.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the

[61] Study and portfolio review of the projects on industrial symbiosis in DG Research and Innovation: Findings and recommendations, March 2020 http://ec.europa.eu/info/publications/study-and-portfolio-review-projects-industrial-symbiosis-dg-research-and-innovation-findings-and-recommendations_en

	Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [62].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: 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 [63] efficiency compared to the state of the art;
- Enable 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;
- Reduce the CO2 intensity of the process industry and contribute to the climate neutrality goal;
- Enable the increase of 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 the handing of a higher feedstock variability, and ultimately leading to lower level of GHG emissions linked to the process industries. To reach ambitious targets regarding resource efficiency, disruptive process technologies must be developed in addition to process efficiency options for existing technologies.

Proposals should:

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62 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

63 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

- Develop disruptive process technologies to improve resource efficiency, such as 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 to prevent and minimise waste generation by, e.g. processes that adjust in real time to feedstock changes or that have tighter processing control 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. This should also include the assessment of possible societal and environmental impact and the effects on the workplaces (skills, organisational change, and others).

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.

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.

Clean steel
Proposals are invited against the following topic(s):

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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 10.00 million.
Type of Action	Innovation Actions
Eligibility	The conditions are described in General Annex B. The following

conditions	exceptions apply: 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).
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 following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [64].

Expected Outcome: As mentioned in the Clean Steel Partnership (CSP) Strategic Research and Innovation Agenda (SRIA),[65] digitalisation and social aspects are both addressed in the Building Block (BB) 10 because of their strong role of enabling the carbon neutral transition. In particular, digitalisation enables all the other BBs, 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.

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 CO_2 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);

[64] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[65] https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf

- 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;

- Application of digital technologies such as, for example, Digital Twins and/or enhanced statistical analysis, machine learning (ML) algorithms, or artificial intelligence (AI) to develop decision-supported planning and process monitoring tools operable in offline or online modes;

- Traceability of materials and process information throughout the value chain to promote improved product quality, efficiency and process integration control (including multi-scale modelling of structure, and structure vs. properties correlations).

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[66]). 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.

Scope: As mentioned in the Clean Steel Partnership (CSP) Strategic Research and Innovation Agenda (SRIA)[67], digitalisation and social aspects are both addressed in the Building Block (BB) 10 because of their strong role of enabling the carbon neutral transition. In particular, digitalisation enables all the other BBs, as evidenced in Table 12 of the CSP SRIA. So, an optimal deployment of digitalization implementing the integrated approach along the steel value chain should be provided.

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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 20.00 million.
Type of Action	Research and Innovation Actions
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.
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.

66 https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf
67 https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf

Projects outcomes will enable achieving the objectives of the Clean Steel Partnership (CSP) by contributing to one of the following two aspects:

1. Enhance CO_2-neutral steel production with hydrogen, secondary carbon carriers and electricity;

2. Contribute to innovative steel applications for low CO_2 emissions.

Projects related to the above point 1 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[68] 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-CO_2 hydrogen to heat up 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-CO_2 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 CO_2 neutral solutions (e.g. H_2 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 are expected to involve among the consortium a balanced representation from academia, research centres and industry and to be developed in contact with the European Commission.

[68] 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).

OR

Projects related to the above point 2 are expected to contribute to at least two of the following outcomes, which require designing steel alloys and products and validating their application for the clean steel market (related to the CSP specific objective 6, see also Building Block 12: Innovative steel applications for low CO_2 emissions in SRIA[69]):

- 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 CO_2 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;

[69] https://www.estep.eu/assets/CleanSteelMembersection/CSP-SRIA-Oct2021-clean.pdf

- 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, corresponding respectively to the points 1) and 2) outlined under the expected outcomes section:

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/CO_2 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 but not limited to synchrotron and/or neutron facilities, should be considered as capable of providing large

amount of statistically relevant data to validate chemistry and structure / morphology and solve challenges concerning hydrogen embrittlement and/or residual stresses. Proposals should demonstrate the CO_2 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 the Clean Steel Partnership (e.g. exchange of information, carbon reduction potential etc.).

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

Call - TWIN GREEN AND DIGITAL TRANSITION 2024 TWO STAGE

HORIZON-CL4-2024-TWIN-TRANSITION-01-TWO-STAGE

Conditions for the Call

Indicative budget(s)[70]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[71]	Indicative number of projects expected to be funded
		2024		
Opening: 19 Sep 2023 Deadline(s): 07 Feb 2024 (First Stage), 24 Sep 2024 (Second Stage)				
HORIZON-CL4-2024-TWIN-TRANSITION-01-01	RIA	25.00	4.00 to 5.00	5
HORIZON-CL4-2024-TWIN-TRANSITION-01-12	RIA	12.00	5.00 to 6.00	2

[70] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[71] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Overall indicative budget		37.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Manufacturing Industry

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-TWIN-TRANSITION-01-01: Bio-intelligent manufacturing industries (Made in Europe Partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 4.00 and 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 25.00 million.
Type of Action	Research and Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation

	pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [72].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: European manufacturing industries are reinforced through biological transformation; in particular

- Access to bio-intelligent production technologies and architecture;
- Technological advances and improvements in sustainability (in particular SDGs 11, 12 and 13) arising from the integration of bio-intelligent principles, functions, structures and technologies in manufacturing;
- Substitution of raw materials by bio-based materials, or implementation of bio-based or bio-intelligent manufacturing operations, and business models leading to regenerative production.

Scope: The biological transformation of industry is a pioneering frontier that the industry of the Union and Associated Countries can harness to enhance circularity and sustainability, while advancing production efficiency and competitiveness.

[72] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

The biological transformation of industry involves the integration of bio-intelligent structures, processes, organisms or materials into technology by systematically applying knowledge from biology. This should lead to a necessary convergence of biotechnology with mechanical engineering, production technology and information technology with new possibilities for the flexible adaptation of production and value creation processes to requirements, especially in the context of sustainability.

The biological transformation of industries includes but is not limited to:

- Bio-inspired manufacturing processes (biomimicry, biomimetics);
- Development of bio-intelligent manufacturing systems or tools;
- Expanding opportunities of bio-intelligent and bio-based materials by substituting fossil-based raw materials and limiting the release of microplastics, e.g. in the textile industry;
- 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 foster 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 or bio-intelligent products in one manufacturing value chain. In addition, sustainable business models need to be developed for production and recycling of the products.

Proposals should address either advanced manufacturing techniques (e.g. additive manufacturing, extrusion, moulding etc.) to process bio-materials or bio-intelligent components for upscaled production; or bio-intelligent production technologies; or combinations of these two approaches.

The focus of this topic is on manufacturing. The development of materials beyond the manufacturing context is 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.[73]

[73] Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning_fair_into_reality_1.pdf

Additionally, a strategy for skills development should be presented, associating social partners and civil society where relevant. Collaboration with EIT Manufacturing is encouraged, in particular on the development of skills.

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, for example with Horizon Europe Cluster 6 and its Destination on Circular Economy and Bioeconomy sectors and/or its Partnership Circular Bio-based Europe (CBE)[74].

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

A New Way to Build, accelerating disruptive change in construction

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 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 12.00 million.
Type of Action	Research and Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve TRL 6 by the end of the project – see General Annex B.

[74] http://www.cbe.europa.eu

Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [75].

Expected Outcome:

- Extension of the service life of civil engineering infrastructure, which reduces the need to replace infrastructure, and ultimately in an overall lower CO-2 footprint for such 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, environmental and climate 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:

[75] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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

- Build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed.

- Present a strategy for skills development, associating social partners where relevant, integrating SSH aspects and including relevant tools such as MOOCs (massive open online courses).

- 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.

- 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.

Destination 2: Increased Autonomy in Key Strategic Value Chains for Resilient Industry

This destination will directly support the following Key Strategic Orientations (KSOs), as outlined in the Strategic Plan[76]:

- KSO C, '**Making Europe the first digitally-enabled circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems'

- KSO A, '**Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations'

- KSO D, '**Creating a more resilient, inclusive and democratic European society**, prepared and responsive to threats and disasters, addressing inequalities and providing high-quality health care, and empowering all citizens to act in the green and digital transitions.

Proposals for topics under this Destination should set out a credible pathway to contributing to the following expected impact of Cluster 4:

- **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.

The COVID-19 crisis, the war against Ukraine and other crises have shown that global competitiveness and resilience are two sides of the same coin. Resilience is about more than the ability to withstand and cope with shocks; it is an opportunity to undergo transitions in a sustainable and fair way. As the European Union and Associated Countries gear up to becoming a climate-neutral, circular and competitive economy by 2050, resilience will require paying attention to new vulnerabilities as entire sectors undergo deep transformations while creating opportunities for Europe's industry to develop its own markets, products and services which boost competitiveness.

Research and innovation will be fundamental to spur industrial leadership, enhanced sustainability and resilience. It will support the modernisation of traditional industrial models while developing novel technologies, business models and processes. This should enhance the

[76] Whilst Cluster 4 addresses KSOs A, C and D, KSO B is becoming increasingly important, given the role of the industry highlighted in the zero-pollution action plan.

flexibility of the EU's industrial base, and increase its resilience by reducing EU dependencies on third countries for critical raw materials and technologies.

The most relevant policies of the European Commission on this front are:

- The European Industrial Strategy of March 2020, and in particular the Update of May 2021: there is now a renewed momentum in the EU to tackle its strategic dependencies as well as to boost its resilience across key strategic areas. The Covid-19 crisis revealed the importance of improving production response and preparedness of EU industry, in support of its long-term competitiveness. The Industrial Strategy Update and the accompanying Staff Working Document on strategic dependencies, showed that 99 products in the most sensitive ecosystems included materials on the list of critical raw materials.

- The Circular Economy Action Plan of March 2020 announced initiatives along the entire life cycle of products. It targets how products are designed, promotes circular economy processes, encourages sustainable consumption, and aims to ensure that waste is prevented and resources used are kept in the EU economy for as long as possible.

- The Chemicals Strategy for Sustainability of October 2020 strategy aims to better protect citizens and the environment whilst boosting the innovation for safe and sustainable chemicals. It calls for actions in the frame of research and innovation to develop a Safe and Sustainable by Design (SSdB) framework and criteria and a Strategic Research and Innovation Agenda addressing research and innovation needs raised in the Strategy and beyond.

- The Zero Pollution Action Plan of May 2021 set's out the objective that by 2050 air, water and soil pollution shall be reduced to levels no longer considered harmful to health and natural ecosystems, that respect the boundaries of the planet. The action plan aims to strengthen the EU green, digital and economic leadership, whilst creating a healthier, socially fairer Europe and planet. It provides a compass to mainstream pollution prevention in all relevant EU policies, to step up implementation of the relevant EU legislation and to identify possible gaps.

- The Materials 2030 Roadmap, presented by a large group of stakeholders, will enable the green and digital transition, anchoring on good design principles, combined with synergies between advanced materials, circularity, digital and industrial technologies. It calls for the evolution of materials research by uniting digital and material capacities and competences, combining technology push with market pull and united actions at Member States level, to benefit from Europe's strength.

- The Digital Decade of March 2021, where the Commission presented a vision, targets and avenues for a successful digital transformation of Europe by 2030.

- The Fit for 55 Package of July 2021, delivering the EU's 2030 Climate Target on the way to climate neutrality, given the process industries' 20% share of global greenhouse gas emissions.

The topics serving the objectives of this destination are structured as follows:

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

Since the Work Programme 2021-22 was drafted, strategic dependencies have increased in importance, given their prominence in accelerating and delivering the green and digital transformation of the EU's key industrial ecosystems, as well as the objective of supporting a more resilient European industry. The transition of the European industrial ecosystems is dependent on the supply of raw materials (both from primary and secondary sources) as many digital and green technologies rely on this supply. The focus in this Work Programme is on Diversifying the international supply chains of critical raw materials; and on Developing internal capacity for primary and secondary raw materials production.

- **Safe and Sustainable by Design (SSbD) chemicals and materials**

Safe and Sustainable by Design (SSbD) is an approach to the design, development and use of chemicals and materials that focuses on providing a function (or service), while reducing harmful impacts to human health and the environment. The Commission published a framework and criteria for Safe and Sustainable chemicals and materials in 2022. Projects across Horizon Europe developing new chemicals or materials are expected to adhere to the framework as of this Work Programme.

Under Horizon 2020 a series of research projects were funded aimed to define and implement a Safe-by-Design concept for nanomaterials. This generated a knowledge base that serves as the foundation for the SSbD concept, which is now a key feature of the Chemical Strategy for Sustainability. The new SSbD concept covers chemicals and materials, including advanced materials and therefore nanomaterials.

The focus on this work programme is on extending the portfolio of methods and models applicable in the SSbD framework as well as on the actual application of the framework to develop SSbD alternatives to substances of concern. Projects resulting from the SSbD topics are expected to contribute to extending the available scientific knowledge base for regulations and policy making.

- **Strategic Innovation Markets driven by Advanced Materials**

Materials, in particular advanced materials, are not only the backbone and source of prosperity of the European society. They will also play a decisive and enabling role in the twin green and digital transition. The Materials2030 Roadmap highlighted that innovation markets are the industrial perspective presenting the "market pull" to address societal needs and challenges under a long-term perspective. The focus in this Work Programme is on a systemic approach to develop the next generation solution-oriented advanced materials, which

will offer faster, scalable and efficient responses to the societal and technological challenges, that are relevant and can be considered as opportunities for Europe's society, economy and environment today and over the next three decades. The competition for critical raw materials (CRMs) Europe's open strategic autonomy at risk in key technologies of the twin green and digital transition. Advanced materials may mitigate these risks by replacing or substituting CRMs.

Moreover, this Work Programme addresses data exchange and interoperability in materials modelling and characterisation across value chains, to support the green and digital transformation of European industry.

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

EU companies, in particular SMEs, need to have capabilities to respond in an agile and effective way to supply disruption, but also to be better equipped for dealing with such shocks in the future.

Business cases and exploitation strategies for industrialisation: This section applies only to those topics in this Destination, for which proposals should demonstrate the expected impact by including a *business case and exploitation strategy for industrialisation*.

The *business case* should demonstrate the expected impact of the proposal in terms of enhanced market opportunities for the participants and deployment in the EU, in the short to medium term. It should describe the targeted market(s); estimated market size in the EU and globally; user and customer needs; and demonstrate that the solutions will match the market and user needs in a cost-effective manner; and describe the expected market position and competitive advantage.

The *exploitation strategy* should identify obstacles, requirements and necessary actions involved in reaching higher TRLs (Technology Readiness Levels), for example: matching value chains, enhancing product robustness; securing industrial integrators; and user acceptance.

For TRL 7, a credible strategy to achieve future full-scale deployment in the EU is expected, indicating the commitments of the industrial partners after the end of the project.

Where relevant, in the context of **skills**, it is recommended to develop training material to endow workers with the right skillset in order to support the uptake and deployment of new innovative products, services, and processes developed in the different projects. This material should be tested and be scalable, and can potentially be up-scaled through the European Social Fund Plus (ESF+). This will help the European labour force to close the skill gaps in the relevant sectors and occupational groups and improve employment and social levels across the EU and associated countries.

In order to achieve the expected outcomes, for particular topics **international cooperation** is not mandatory but advised with some regions or countries, to get internationally connected and add additional specific expertise and value to the activities.

To achieve wider effects **activities beyond R&I investments** will be needed. Wider activities include the further development of skills and competencies (also via the European Institute of Innovation and Technology, in particular EIT Raw Materials, EIT Climate-KIC and EIT Digital); and the use of financial products under the InvestEU Fund for further commercialisation of R&I outcomes.

Synergies:

For **raw materials**, there are synergies with energy-intensive industries and in particular the circularity part; and with strategic innovation markets driven by advanced materials. A further synergy is with Cluster 5: Renewable energies and energy storage.

Safe and Sustainable by Design presents synergies with

Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture' in areas Bio-based Innovation Systems in the EU Bioeconomy and Circular Systems;

Cluster 5 'Climate, Energy and Mobility' in view of areas on lightweight materials;

Cluster 1 'Health', Destination 'Living and working in a health-promoting environment: research on impact of chemicals on human health'; and

Horizon Europe Partnership on the Assessment of Risks from Chemicals (PARC): on exposure and hazard activities as well as the SSbD toolbox and case studies.

Strategic Innovation Markets driven by Advanced Materials presents synergies with the energy-intensive and manufacturing industries, in view of both the circularity approaches and low-carbon technologies; and with

Cluster 1 'Health', in view of areas on bio-based materials;

Cluster 5 'Climate, Energy and Mobility' in view of areas on lightweight materials;

Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture' in view of areas on agrochemicals.

While focusing *exclusively* on civilian applications, there may be synergies with actions conducted under the European Defence Fund (EDF) or its precursor programmes (Preparatory Action on Defence Research and European Defence Industry Development Programme), notably in the field of advanced sensing and advanced materials.

Innovation Actions — Legal entities established in China are not eligible to participate in Innovation Actions in any capacity. Please refer to the Annex B of the General Annexes of this Work Programme for further details.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)	Deadline(s)

	2023	2024	
HORIZON-CL4-2023-RESILIENCE-01-TWO-STAGE	124.00		07 Mar 2023 (First Stage) 05 Oct 2023 (Second Stage)
HORIZON-CL4-2023-RESILIENCE-01	213.00		20 Apr 2023
HORIZON-CL4-2024-RESILIENCE-01-TWO-STAGE		62.00	07 Feb 2024 (First Stage) 24 Sep 2024 (Second Stage)
HORIZON-CL4-2024-RESILIENCE-01		160.20	07 Feb 2024
Overall indicative budget	337.00	222.20	

Call - RESILIENT VALUE CHAINS 2023 TWO STAGE

HORIZON-CL4-2023-RESILIENCE-01-TWO-STAGE

Conditions for the Call

Indicative budget(s)[77]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[78]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 07 Mar 2023 (First Stage), 05 Oct 2023 (Second Stage)				
HORIZON-CL4-2023-RESILIENCE-01-32	IA	31.00	6.00 to 8.00	4
HORIZON-CL4-2023-RESILIENCE-01-33	RIA	31.00	6.00 to 8.00	4
HORIZON-CL4-2023-RESILIENCE-01-34	RIA	31.00	6.00 to 8.00	4
HORIZON-CL4-2023-RESILIENCE-01-37	RIA	31.00	6.00 to 8.00	4
Overall indicative budget		124.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.

[77] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[78] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Strategic innovation markets driven by advanced materials

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 31.00 million.
Type of Action	Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
Technology Readiness Level	Activities are expected to start at TRL 4 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: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.

Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: This topic refers to the innovation market[79] for *Sustainable Textiles* and will support citizens and their needs. Europe's textile sector, its technology providers and research community are world leading. The most technologically advanced textile products are being manufactured in Europe and new manufacturing value chains such as technical textiles, in the 1990's and early 2000's are developed in Europe first.

Several materials specifications and related innovations needs will support this topic such as renewable and recyclable materials, alternative active ingredients, design for circularity.

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 or limit the need to use chemical additives or coatings will have a positive impact on the environment, the climate, and the circularity of textile materials, in view of the Safe and Sustainable by Design Framework.
- Smart functions or functionalities of textiles will address future consumer needs.
- Low-cost, low-resource, and low environment-impact high performance durable fibres and textiles from renewable sources will serve for technical end markets.
- Develop effective circularity enabling technologies for technical textiles, non-woven and fibre-reinforced composites, e.g. biopolymer or natural fibre based high performance fibres.
- Use of hazardous chemical processing shall be reduced and reserved for crucial technical functionalities of textiles.
- Designed circularity for renewables and recyclable materials supporting the sustainable use of textiles, reducing the CO_2-footprint of the textiles industry.

Scope: Proposals **should address at least three 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

79 http://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/advanced-materials-2030-manifesto.pdf

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. This is expected to translate into lower GHG-emissions in the textiles value chain, as well as reducing landfill waste volumes.
- 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.

Dovetailing with digital technology, e.g. sensors, is encouraged.

Materials and products should be developed under Safe and Sustainable by Design framework[80] 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 Electronic Appliances market (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 31.00 million.
Type of Action	Research and Innovation Actions

[80] See documents defining the SSbD framework on: http://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [81].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: This topic refers to the innovation market for *electronics appliances*, in support of citizens and their various needs (be it in health care, home &personal care, food or textiles). Several materials specifications and related innovations needs will support this topic such as renewable and recyclable materials, alternative active ingredients and design for circularity. The topic should address several key policies of the European Union such as the

[81] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Circular Economy Action Plan, the Zero Pollution Action Plan, the EU Chemicals Strategy, the EU Strategy for sustainable textiles.

Sensors are a key technology for electronic appliances serving 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 Electronics Appliances 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.
- Smart sensor technology can support self-monitoring in fitness and well-being, decentral personal health monitoring, environmental monitoring, as well as cooling and thermal distribution and 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 at least four of the following activities**:

- Biosensors and chemical sensors can be applied to detect and monitor analytes or pathogens in the environment, in healthcare settings, and in 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 sensor materials with properties such as stretchability, self-healing and self-cleaning for the 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 should be developed under Safe and Sustainable by Design framework[82] taking into account circularity aspects.

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, 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 and bio-based) materials for sustainable agriculture (RIA)

Specific conditions

[82] See documents defining the SSbD framework on: http://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 31.00 million.
Type of Action	Research and Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- Producers of agrochemicals will provide alternative chemicals and/or bio-based materials following the safe and sustainable by design framework to farmers and comply with relevant agri-food market authorisations.
- Advanced (nano)materials and/or bio-based materials will provide farmers with alternative tools to reduce the use of pesticides and fertilizers, thereby reducing the environmental footprint of these agrochemicals.
- Support to the EU climate ambitions[83] 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 and where relevant the Farm to Fork Strategy.

[83] http://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan_en

- Support to the goals of the Mission 'A Soil Deal for Europe[84], i.e., such as reducing soil pollution and use of hazardous substances.

- Support the EU goals of the Ocean and Waters mission,[85] i.e., prevent and eliminate pollution by reducing use of fertilizers and chemical pesticides by 50%.

Scope: This topic refers to the innovation market[86] for sustainable agriculture. The next generation of fertilisers, biocides and plant protection products for agriculture should need to be based on new delivery systems made from advanced (nano)materials (nanosubstances and nanoformulations of conventional substances) or and/or bio-based materials, to enable target-specific, precise and slow release of the product, reduction of load of active substances, ease of application, reduced risk for non-target organisms and operator exposure, reduced wash-off, reduced costs for farmers, etc.

Proposals **should address at least four of the following activities, the second bullet point being compulsory**:

- Develop advanced (nano)material-based delivery systems and/or bio-based materials for agriculture. The new agrochemicals should exhibit less GHGs emissions, improved efficiency, improved toxicity and ecotoxicity profile 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 and/or bio-based materials (including biopolymers and biodegradable polymers) for which they will provide a sound risk and safety assessment including toxicity evaluation for non-target organisms, and humans and environment, and sustainability assessment along their entire life-cycle, including a holistic assessment of the short-, medium- and long-term impact (environmental, economic, social) of all substances/materials of the proposed solution. The safety and sustainability assessment should be done according to the Safe and Sustainable by Design framework.[87] This activity needs to be addressed by all proposals.

- Undertake a 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

84 http://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

85 http://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

86 http://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/advanced-materials-2030-manifesto.pdf

87 See documents defining the SSbD framework on: http://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

well as case studies (e.g., type of crop for agrochemicals testing, etc.) should include environmental and socio-economic aspects.

- The proposals should build on existing standards for production and risk assessment, when available and relevant, and should consider the requirements laid down in the 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[88] or the EFSA guidance on specific protection goal and ecosystem services [89] for environmental assessment and sustainability).

- Data produced during the development of new agrochemicals should be FAIR[90] and the FAIRness should also be demonstrated and shared through available platforms (e.g., IPCHEM[91], e-NanoMapper[92], 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., EU Nanosafety Cluster[93]) and platforms, in particular with the European Platform on Life Cycle Assessment (EPLCA)[94].

This topic requires the effective contribution of Social Sciences and Humanities (SSH) disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise in particular in social and economic assessments, to produce meaningful and significant effects enhancing the societal impact of the related research activities. An early involvement of end users could be essential.

Proposals submitted under this topic should include a business case and exploitation strategy, as outlined in the introduction to this Destination. Proposals should seek links with and capitalise on the results of relevant past and ongoing EU funded research projects, including the ones under Cluster 6 'Food, Bioeconomy, Natural Resources and Environment'. Namely, the proposals are expected to have synergies with the topic HORIZON-CL6-2023-FARM2FORK-01-7: Innovations in plant protection: alternatives to reduce the use of pesticides focusing on candidates for substitution.

HORIZON-CL4-2023-RESILIENCE-01-37: Advanced materials for magnets in applications for the New Energies Market (RIA)

Specific conditions

88 EFSA Guidance on risk assessment of nanomaterials including Appendices D.2 for pesticides, D.5 for nanocarriers and D.6 for fertilisers; http://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/j.efsa.2021.6768
89 http://www.efsa.europa.eu/en/efsajournal/pub/4499
90 http://www.go-fair.org/fair-principles/
91 http://ipchem.jrc.ec.europa.eu/
92 http://www.enanomapper.net/
93 http://www.nanosafetycluster.eu/
94 http://eplca.jrc.ec.europa.eu/

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 31.00 million.
Type of Action	Research and Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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 innovation 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.

In order to deliver the EU's 2030 climate targets under the ‘Fit For 55’ 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 shall contain in future lesser amounts of rare-earth metals, in view of the geostrategic dependency on critical raw materials, including rare-earth metals.

Projects are expected to contribute to the following outcomes:

- Europe's industry will benefit from advanced materials for magnets that are either free from rare-earth metals, or use to a significant extent a substitute and reduce the share of rare-earth metals magnets (compared to the state of art). This will alleviate the dependency and possible supply risks and strengthen Europe's open strategic autonomy and competitiveness.

- Europe used 16 kt of rare earths in 2020, and most of them were used to manufacture permanent magnets (NdFeB). This market is still increasing due to the massive electrification of the energy industries. If new magnet composition is successfully developed by 2030 (Nd1Fe12 phases, NdFeMo, high entropy alloys) this permanent magnet could be widely applied, also in offshore wind energy and in industry.

- 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 at least four of the following activities**:

- The deployment of permanent-magnets in the energy (e.g. wind-turbine engines for power generation) is of major importance for reaching the green deal ambitions. To achieve this whilst reducing Europe's dependency on Critical Raw Materials, the 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/m^3) 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. These doped perovskite manganite oxide nanostructures should have the potential to achieve similar or improved magnetic properties such compared to as NdFeB magnets.

- Advanced material models and simulation tools to extend the usage range of the current critical materials and shorten the development and certification cycle of new materials and processes.

- 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.

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 5 “Climate, Energy, Mobility”.

Call - RESILIENT VALUE CHAINS 2023

HORIZON-CL4-2023-RESILIENCE-01

Conditions for the Call

Indicative budget(s)[95]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project	Indicative number of

[95] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

		2023	(EUR million)[96]	projects expected to be funded
Opening: 08 Dec 2022 Deadline(s): 20 Apr 2023				
HORIZON-CL4-2023-RESILIENCE-01-02	RIA	25.00 [97]	Around 5.00	5
HORIZON-CL4-2023-RESILIENCE-01-03	IA	22.00	Around 7.30	3
HORIZON-CL4-2023-RESILIENCE-01-05	IA	28.00 [98]	Around 7.00	4
HORIZON-CL4-2023-RESILIENCE-01-06	IA	20.00 [99]	Around 6.70	3
HORIZON-CL4-2023-RESILIENCE-01-07	CSA	3.00	Around 3.00	1
HORIZON-CL4-2023-RESILIENCE-01-09	IA	20.00 [100]	Around 6.70	3
HORIZON-CL4-2023-RESILIENCE-01-21	RIA	29.00 [101]	6.00 to 8.00	4
HORIZON-CL4-2023-RESILIENCE-01-22	RIA	15.00 [102]	3.00 to 4.00	4
HORIZON-CL4-2023-RESILIENCE-01-23	RIA	29.00 [103]	6.00 to 7.00	4
HORIZON-CL4-2023-RESILIENCE-01-39	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-RESILIENCE-01-42	CSA	10.00 [104]	2.00 to 3.00	4
HORIZON-CL4-2023-RESILIENCE-01-44	IA	10.00 [105]	Around 5.00	2
Overall indicative budget		213.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General

96 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
97 Of which EUR 5.00 million from the 'NGEU' Fund Source.
98 Of which EUR 11.00 million from the 'NGEU' Fund Source.
99 Of which EUR 8.00 million from the 'NGEU' Fund Source.
100 Of which EUR 8.00 million from the 'NGEU' Fund Source.
101 Of which EUR 4.90 million from the 'NGEU' Fund Source.
102 Of which EUR 3.50 million from the 'NGEU' Fund Source.
103 Of which EUR 5.55 million from the 'NGEU' Fund Source.
104 Of which EUR 4.00 million from the 'NGEU' Fund Source.
105 Of which EUR 4.00 million from the 'NGEU' Fund Source.

	Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

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

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 25.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: To increase EU resilience in raw materials supply chains and thus reduce the serious risk 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. *"*African Union member states" includes countries whose membership has been temporarily suspended.*
Technology Readiness Level	Activities are expected to achieve TRL 3-5 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 exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [106].

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[107] for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

[106] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[107] https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

- Develop innovative technologies for extraction of raw materials in the European Union.
- 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[108].
- Show the potential to reduce substantially the Green House Gases (GHGs) emissions intensity of extraction per ton of the material (metal, metal content, concentrate, mineral) sold on to the downstream value chain, thus contributing to EU climate neutrality objectives.
- 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 technologies.

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 water use and GHG intensity of extraction.

Actions should be driven by industry and raw materials users. The actions should duly justify the relevance of all targeted minerals and metals. Priority are the EU critical raw materials. 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)

Specific conditions

[108] https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 7.30 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 22.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: To increase EU resilience in raw materials supply chains and thus reduce the serious risk 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. *"*African Union member states" includes countries whose membership has been temporarily suspended.*
Technology Readiness Level	Activities are expected to start at TRL 6 and achieve TRL 7 by the end of the project – see General Annex B.
Exceptional page limits to	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally

proposals/applications	extended by 3 pages.

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[109] 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.[110]

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[111]

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, reduction of waste, higher energy efficiency. The action can 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.

The solution proposed should be flexible enough to adapt to different or variable ore grades and extractive waste streams 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.

109 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en
110 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1
111 COM (2020) 474

Recycling of end-of-life products is excluded from this topic, though joint processing of waste streams originating from end-of-life products recycling could be included and has to be duly justified.

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 deployment 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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 7.00 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 28.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: To increase EU resilience in raw materials supply chains and thus reduce the serious risk 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. *"*African Union member states" includes countries whose membership has been temporarily suspended.* 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).
Technology Readiness Level	Activities are expected to start at TRL 6 and achieve TRL 7 by the end of the project – see General Annex B.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

Expected Outcome: Projects outcomes will enable the expected impacts of the destination by increasing access to secondary raw materials, in particular critical raw materials[112] 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

[112] https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

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.[113] [114]

- Demonstrate contribution to EU climate neutrality objectives.

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[115], waste windmills[116] and solar PV and machine tools (e.g. hard metal scrap). 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, characterisation, 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.

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113 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1

114 COM (2020) 474

115 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

116 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

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.

Actions should clearly demonstrate how they contribute to a decreased level of resource and energy consumption, leading to a lower CO_2 footprint.

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 deployment 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, products and services for raw materials (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 6.70 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 20.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: To increase EU resilience in raw materials supply chains and thus reduce the serious risk 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and

	countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. *"*African Union member states" includes countries whose membership has been temporarily suspended.* 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).
Technology Readiness Level	Activities are expected to start at TRL 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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [117].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

[117] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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[118] 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.[119]

Improve knowledge on raw materials resources in Europe.

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[120]

-Develop best practices and standards for innovate EO technologies, products and services for a more efficient permitting and environmental compliance processes.

Scope: Actions should develop leverage on existing Copernicus DIAS[121] or other Earth Observation platform for raw materials similar to ESA [122] platforms, and create a sustainable business model that can facilitate access to developed Earth Observation technologies, products and services to be integrated into the mining industry and public stakeholder workflows supporting any phase in the full mine life cycle.

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, Africa countries or Latin America).

Actions 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 / or products to generate value-added raw materials information products, pre-processed optical and radar data from the Sentinel satellites and related Copernicus services 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.

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118 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en
119 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1
120 COM (2020) 474
121 Data and Information Access Services
122 European Space Agency

Actions should improve mineral exploration at regional scale and target definition at local scale, exploiting European 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 European airborne and satellites high and very high-resolution imagery.

Actions should map and monitor secondary raw materials in the Europe exploiting the Copernicus Land Monitoring Service or other EO satellites derived products.

Actions should monitor ground stability in active and/or abandoned mining areas in Europe, exploiting the European Ground Monitoring Service of Europe (Copernicus EGMS) and similar initiatives, as well as data form Sentinels and/or Copernicus Contributing Missions.

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. Also, it should assist in remediation activities following mine closure.

Actions should develop best practices and standards for innovate EO technologies, products and services in the raw materials life cycle for a safer, efficient, responsible and sustainable mining.

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 deployment 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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3.00 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 3.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: To increase EU resilience in raw materials supply chains and thus reduce the serious risk 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. *"*African Union member states" includes countries whose membership has been temporarily suspended.* 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [123].

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 (CRM) [124] 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.[125]

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[126]

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123 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

124 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

125 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1

126 COM (2020) 474

Scope: Actions should strengthen an EU expert network and community covering all raw materials screened in the CRM assessment of 2020 , and additional raw materials screened in 2023 assessment (neon, krypton, xenon, roundwood). Flexibility in screening additional raw materials is an added value.

The consortium should build the EU expert community covering each screened raw material with 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, security and aerospace.

The actions should 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 improve data and knowledge on all screened raw materials; and 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.

The action should update the data and information fact sheets from the previous criticality exercise for all screened raw materials, and ensure their quality by relevant raw material experts. Factsheets are to be finalised by the end of 2025, and could be fine-tuned before publication expected in 2026.

The action is expected to organise two expert validation workshops in 2025 to support the EU criticality assessment, and validate draft factsheets for all screened materials. On request of the Commission, organise in-depth workshops on several strategic metals (agreed with the Commission) for renewable energy, e-mobility and security with recognised commodity experts from industry and other organisations.

The action should provide policy briefs and analyses based on requests from the Commission and proposed work shall be coordinated with the Commission's work and relevance reviewed in the light of policy development and needs.

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

Specific conditions	
Expected EU contribution	The Commission estimates that an EU contribution of around

per project	EUR 6.70 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 20.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: To increase EU resilience in raw materials supply chains and thus reduce the serious risk 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. *"*African Union member states" includes countries whose membership has been temporarily suspended.* 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).
Technology Readiness	Activities are expected to start at TRL 6 and achieve TRL 7 by

Level	the end of the project – see General Annex B.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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[127] for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

- Develop more cost effective and resource efficient rare earth permanent magnets.
- Improve recyclability, re-use, refurbishment and/or repurposing 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.[128]
- Demonstrate contributions to EU climate neutrality objectives.

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials[129] and the action plan on Rare Earth Magnets and Motors from the European Raw Materials Alliance[130].

Scope: Actions should improve design of rare earth permanent magnets that facilitate the reuse, re-use, refurbishment and/or repurposing 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

127 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en
128 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1
129 COM (2020) 474
130 https://erma.eu/european-call-for-action/

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.

Actions should clearly demonstrate how they contribute to a decreased level of resource and energy consumption, and thus lead to a lower CO2 footprint.

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 deployment 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.

Safe and Sustainable by Design (SSbD) Chemicals and Materials

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 29.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The Joint Research Centre (JRC) may participate as member of the consortium selected for funding.
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.

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

- EU strategies/policies and regulations, such as the (proposed) Ecodesign for Sustainable Products Regulation[131], the EU Ecolabel[132], REACH[133] or CLP[134] can build on new methods and the associated data for chemicals and materials;

- Methods and data will be made available in a format which will allow existing validation networks or bodies (e.g., the EU Reference Laboratory for alternatives to animal testing (EURL ECVAM) or the OECD) or other platforms to launch a validation/standardisation process and to promote wider uptake of the new methods developed;

- 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 and nanomaterials, supporting the implementation of the Safe and Sustainable by Design framework[135].

Scope: The Commission initiative for Safe and Sustainable by Design[136] (SSbD) sets a framework for assessing the safety and sustainability of chemicals and materials, which should be considered as a reference for project proposals. This topic aims at developing new methods, or improve existing 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[137], which predominantly contains test methods harmonised under the OECD[138]. 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. An advance in alternative methods for safety assessment (e.g., New Approach Methodologies, NAMs) is needed, preferably without animal models, but also to support modelling and design of new Safe and Sustainable by Design 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 the entire life cycle including the 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 for a robust assessment.

131 https://ec.europa.eu/environment/publications/proposal-ecodesign-sustainable-products-regulation_en
132 https://ec.europa.eu/environment/ecolabel/the-ecolabel-scheme.html
133 https://ec.europa.eu/environment/chemicals/reach/reach_en.htm
134 https://echa.europa.eu/regulations/clp/legislation
135 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en
136 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en
137 https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX%3A32008R0440
138 https://www.oecd.org/chemicalsafety/testing/oecd-guidelines-testing-chemicals-related-documents.htm

The development of absolute sustainability methods[139] that consider ecosystems carrying capacities are also needed. 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 gaps in the data for sustainability and life cycle assessment.

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[140]. 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 the current safety and sustainability assessments;

- Methods and models developed can be either for the already existing chemicals and materials or to be used during the design phase of future chemicals and materials;

- For each method or model developed an 'in project interlaboratory' validation should be done, and the method or model shall be shared via the most appropriate open platform, e.g., the Horizon Europe Partnership on the Assessment of Risks from Chemicals (PARC)[141], 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, EU Reference Laboratory for alternatives to animal testing (EURL ECVAM);

- Data produced during the development process and in particular for inclusion in the validation/standardisation dossier must be FAIR [142] and shared through available platforms (e.g., the Information Platform for Chemical Monitoring – IPCHEM[143]). Data for the validation/standardisation dossier shall be produced according to existing guidelines and stored in standardised data formats.

International collaboration on uptake of new methods and/or models shall be enhanced involving relevant players from academia, public authorities and the private sector.

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139 The term absolute sustainability refers to the possibility of a chemical to comply with safety and to carry limited environmental impacts within the planetary boundaries.

140 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

141 https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc

142 Findable, Accessible, Interoperable, Reusable

143 https://ipchem.jrc.ec.europa.eu/

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[144] they will contribute.

Proposals submitted under this topic should demonstrate synergies with the EU-funded projects resulting from the topic HORIZON-CL4-2023-RESILIENCE-01-22. In addition, collaboration with the European Partnership on Assessments of Risks from Chemicals (PARC)[145] is encouraged with regards to their task on delivering the SSbD toolbox. Proposals should allocate the necessary resources for collaboration with the relevant projects mentioned above. Proposals should also build on the extensive experience from European, national or regional clusters/platforms and initiatives such as the Malta Initiative [146] engaged in validation/standardisation of methods.

Co-operation with the European Commission's Joint Research Centre (JRC) may be envisaged in areas of mutual interest with regards to new methods development and their wider uptake.

Synergies with Horizon Europe missions as relevant are encouraged.

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 4.00 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 15.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The Joint Research Centre (JRC) may participate as member of the consortium selected for funding.
Technology Readiness Level	Activities are expected to achieve TRL 2-5 by the end of the project – see General Annex B.

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

144 https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en
145 https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc
146 https://www.bmuv.de/en/topics/health-chemicals/nanotechnology/the-malta-initiative

- The stakeholder community including academia, industry, public authorities and NGOs will have access to more robust and consistent guidelines and methodologies for integrative social, economic, health and environment impact assessment;

- Industry will be enabled to make impact-based informed investment decisions for future chemicals and materials;

- Public authorities and policy makers at EU and national level will be supported in the implementation of policies, including the transition to safe and sustainable chemicals and materials through improved understanding of potential sustainability trade-offs.

Scope: The Commission initiative for Safe and Sustainable by Design[147] sets a framework for assessing safety and sustainability of chemicals and materials, which should be considered as a reference in the proposal.

Proposals should aim to develop integrated approaches for the assessment of health and environmental impacts together with the social and economic sustainability aspects of a chemical or material, all along their life-cycle. The projects should acknowledge and account for the fact that safety and sustainability of a chemical or material are 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 and resulting exposures). The proposals should also aim to foster the acceptance and effective uptake of the developed approaches within different sectors. The developed methodologies should support and facilitate decision making when having to weight multiple sustainability criteria against each other. The developed methodologies should contribute to the estimation of health, environmental as well as social and economic impacts at EU and global scale.

Proposals should consider all the following activities:

- Select chemicals/group of chemicals/(advanced)materials for which they will develop an integrated approach for health, environment, social and economic impact assessments and justify this selection in view of their societal relevance;

- Development of methodologies and associated guidelines for integrated health, environment, social and economic impact assessments. Existing life cycle methodologies should be built on;

- Identification of data gaps and data availability along the value chain as regards all relevant sustainability dimensions (environmental, health, social and economic factors) for the targeted substance/group of substances and in particular identification and monetization of externalities arising during the life cycle of a chemical or a material;

- Identification and engagement of all relevant stakeholders along the value chain to take into account the existence of conflicting interests and potential impacts affecting

147 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

differently each of them. Foster a shared support and agreement on developed methodologies;

- Develop a demonstration of the integrated approach, which can contribute towards its effective acceptance and implementation by different stakeholders;
- Delivery of FAIR[148] data and methodologies including results obtained from applying the methodologies to allow for further testing of the methodologies, enhance acceptance and their wider applications.

Proposals submitted under this topic should demonstrate synergies with the EU-funded projects from the topic CE-NMBP-42-2020 and the forthcoming topic HORIZON-CL4-2023-RESILIENCE-01-21. In addition, collaboration with the European Partnership on Assessment of Risks from Chemicals (PARC)[149] with regards to their task on delivering the SSbD toolbox is encouraged. Concerning health impact assessment, projects are encouraged to establish synergies with projects resulting from the topic HORIZON-HLTH-2022-ENVHLTH-04-01. Proposals should allocate the necessary resources for collaboration with the above-mentioned relevant projects.

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[150] they will contribute.

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.

Co-operation with the European Commission's Joint Research Centre (JRC) may be envisaged in areas of mutual interest with regards to methods development and their wider uptake.

Synergies with Horizon Europe missions as relevant are encouraged.

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 7.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

148 Findable, Accessible, Interoperable, Reusable
149 https://www.anses.fr/en/content/european-partnership-assessment-risks-chemicals-parc
150 https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

Indicative budget	The total indicative budget for the topic is EUR 29.00 million.
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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [151].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- The '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[152];
- The innovation capacity of SMEs and industry will be boosted with cost effective tools to find safe and sustainable alternatives to substances of concern[153];
- Industry will lower the environmental footprint of materials and chemicals through improved production methods and optimised applications from the design phase on;
- Industry will be more agile to respond 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;

151 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

152 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

153 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. A more detailed description is given in the Commission Proposal for an Ecodesign for Sustainable Products Regulation (30.3.2022, COM(2022) 142 final)."

- The EU climate ambitions [154] will be supported by contributing to a decrease of greenhouse gas emissions through a more sustainable production and use of chemicals and materials;

Scope: The Commission initiative for Safe and Sustainable by Design [155] sets a framework for assessing safety and sustainability of chemicals and materials, which should be considered as a reference in the proposal.

For an effective substitution of substances of concern [156] 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 the Safe and Sustainable by Design framework will have a key role in the green and digital transition of the European industry. These tools will allow the exploration of which technical solutions are the most appropriate for respecting the Safe and Sustainable by Design requirements in a cost- and policy-effective manner and thereby accelerate the innovation process for Safe and Sustainable by Design chemicals and materials.

Proposals should therefore:

- Produce innovative modelling software for the development of chemicals and materials (including advanced materials) building on high-throughput chemicals and materials characterisation facilities and relevant models and make it available and interlinked through open platforms accessible to SMEs and industry;

- Develop predictive computational models and software to forecast the sustainability performance and support the assessment of sustainability aspects for newly designed chemicals or materials, in a tiered approach, already in the early stages and along the innovation process;

- Enable the integration of materials modelling, safety and sustainability assessment tools and databases into a single workflow. 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;

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154 https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan_en

155 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

156 See Article 2 of the Proposal for a regulation of the European Parliament and of the Council establishing a framework for setting Ecodesign requirements for sustainable products and repealing Directive 2009/125/EC; https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

- Make developed models on chemicals, materials and their production process FAIR[157], and accompany them with a set of associated test data,
- Apply FAIR data principles. The interoperability for data sharing should be addressed, including synergies with other European projects addressing ontologies for data documentation, for example projects resulting from topic DT-NMBP-39-2020;
- Explore collaboration with existing Open Innovation Test Beds (OITBs)[158], where relevant;
- The tools should be validated against 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 topic HORIZON-CL4-2024-RESILIENCE-01-24 in this Work Programme).

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[159] they would contribute.

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, for developers of computational modelling and users of the models.

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 projects resulting from the topics HORIZON-CL4-2021-RESILIENCE-01-08, HORIZON-CL6-2023-ZEROPOLLUTION and/or HORIZON-CL4-2023-RESILIENCE-01-39. Proposals should allocate the necessary resources for collaboration with other relevant projects.

Synergies with Horizon Europe missions as relevant are encouraged.

Strategic innovation markets driven by advanced materials

Proposals are invited against the following topic(s):

157 Findable, Accessible, Interoperable, Reusable

158 https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/sustainable-production-processes_en

159 https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

HORIZON-CL4-2023-RESILIENCE-01-39: Coordination and knowledge sharing across materials development communities (CSA)

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
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [160].

Expected Outcome:

- A pathway for accelerating advanced material research in line with strategic innovation markets, in particular for generating reliable data and information and for providing easy access to any interested stakeholder;
- A common knowledge base for researchers and industry increasing collaboration between strategic innovation markets driven by advanced materials;
- Overcoming hurdles with regards to the use of digital tools for improved access to and valorisation of data.

Scope: There is a need to integrate and unify digital and materials competences and resources, including data, ontologies, characterisation and modelling, as well as robotics and machine learning, to accelerate the design, development, production and application of advanced materials with the desired manufacturing processes, properties, durability, and end of life. The lack of integration is a major challenge for the advanced materials design and development serving the innovation markets, including the related value chains.[161]

[160] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[161] advanced-materials-2030-manifesto.pdf (europa.eu)

Such collaboration should be extended to the manufacturing industries and their digital marketplaces so that data and information to design new materials can be shared by all interested stakeholders in a faster way.

Platforms integrating materials data management, modelling, characterisation and harnessing machine learning and automation have the potential to accelerate substantially 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. The necessary acceleration and cost decrease should be directly beneficial for any subsequent manufacturing process.

Actions are required that ensure synergies and common approaches across strategic innovation markets driven by advanced materials, to capitalise on commonalities and to ensure interoperability and integration of all methodologies. There should be collaboration with existing European and national data spaces and marketplaces on interfaces and metadata, in order to ease the access and improve the (re-) use of materials data.

Proposals should address all of the following activities:

- Establish an inventory of relevant existing collaborative materials data and information systems (platforms, databases and infrastructures) serving strategic innovation markets.
- Network the identified data and information systems and make them accessible and usable for any stakeholder interested in the research, development or deployment of advanced materials research results.
- Establish common methodologies for data acquisition and knowledge generation:
    - Modelling, including data- and physics-based materials modelling
    - Characterisation, including multi-scale, multi-technique, in/on-line
    - Materials synthesis and fabrication technologies including autonomous robotics platforms
    - Machine learning and AI-based methods
- Based on the scope of the strategic innovation markets, and on the methodologies above for acquiring data and generating knowledge, develop a common language for data documentation and exchange on advanced materials and related manufacturing processes through widely agreed vocabularies, taxonomies as well as relevant domain ontologies based on the Industry Commons Ontology Commons EcoSystem (OCES)128 and the Elementary Multiperspective Material Ontology (EMMO)129, covering all relevant methodologies (including modelling and characterisation).
- Demonstrate easy access to reliable data and information/knowledge by connection of identified databases with the ontologies, providing a resource for the materials developers community and for industries. This demonstration should be done with a

number of case studies in different areas of application of advanced materials and considering the entire value chain.

- Integrate data and methods for life-cycle assessment and take into account the safe and sustainable by design framework for chemicals and materials.
- Establish a cost overview and a business plan for the sustainability for a digital knowledge sharing system and the supporting coordination network across materials development communities and industries up to 2035 and beyond.
- Establish training schemes to facilitate skills development, reskilling and upskilling in the relevant methodologies, with particular emphasis on digital skills for all interested stakeholders.

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 with the "Materials 2030 Roadmap" and any follow up actions.[162]

In order to ensure interoperability and coordination of data architectures, projects should in particular exploit synergies with:

- the projects selected on computational modelling on Safe and Sustainable by Design (HORIZON-CL4-2023-RESILIENCE-01-23);
- the Data Spaces support centre funded under the Digital Europe programme,
- projects related to Common European data spaces, in particular on manufacturing.

Improving the resilience of EU businesses, especially SMEs and Startups

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.00 and 3.00 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 10.00 million.
Type of Action	Coordination and Support Actions
Eligibility	The conditions are described in General Annex B. The following

[162] https://www.ami2030.eu/

conditions	exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [163].

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

- Build a model for each industrial ecosystem to identify disruptions and technological opportunities for the uptake of advanced technologies in a supply chain;
- Alert on current disruptions and identify potential future disruptions;
- Identify potential alternate suppliers of critical advanced technologies;
- Launch one pilot project per each industrial ecosystem focused on building alliances among traditional and tech-savvy SMEs through industrial cluster organisations;
- Explore concrete collaboration opportunities between different type of EU businesses, particularly tech-savvy SMEs and traditional SMEs;
- Increase the adoption of advanced technologies in traditional SMEs, looking at skills shortages among other barriers, and help EU tech-savvy SMEs that developed critical technology applications to expand their market potential in the EU;
- Demonstrate how the adoption of advanced technologies in SMEs can enable them to reduce resource, material and energy consumption, thus contributing to EU climate neutrality objectives.

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

[163] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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.

Through the adoption of advanced technologies, the manufacturing industry will achieve operational independence. 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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 10.00 million.
Type of Action	Innovation Actions

Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Evaluation Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering demonstration activities in diverse geographical areas of the European Union and Associated Countries, grants will be awarded first to the highest ranked application according to the standard procedure described in Horizon Europe General Annexes D and F, followed by other applications that are the highest ranked among those that ensure the most complementary geographical coverage, provided that the applications attain all thresholds. When assessing geographical coverage, the evaluation will take into account the location of the application's demonstration activities, not the location of the application's participants/beneficiaries.

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

- **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*[164] and, more broadly, taking into account the values *and the concept of the New European Bauhaus*[165]. Demonstrators can contribute to a smart neighbourhood approach setting liveability of local communities and residents at the forefront.

- Mobilise within the project a cross-sectoral industrial [166] 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. Examples include 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;

164 *https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1603122220757&uri=CELEX:52020DC0662*
165 *https://europa.eu/new-european-bauhaus/index_nl*
166 Refers to the 14 Industrial Ecosystems for Recovery

- Demonstrators should go the 'extra mile' and prove continuity in terms of a more integrated renovation or new build approach at district level by demonstrating **one or more innovative strand(s)**:

    a. **Adapted and affordable technological innovation** fostering liveability for local communities and residents, accessibility, access to (social) services, improving cohabitation amongst residents and interaction with social housing providers.

    b. **Social innovation,** addressing specific social challenges in housing districts and neighbourhoods. Examples could be models improving the wellbeing of residents, 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.

    c. **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.

    d. **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,…) as well as deployment of a Positive Energy District[167].

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.

Effectively 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.

The 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.

[167] https://jpi-urbaneurope.eu/ped/

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: Industrial 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.

Where 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.
- As a basic condition, energy efficiency and insulation aspects should be already integrated in the renovation scheme; potentially including local renewable energy production and energy communities.
- 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 Affordable Housing Initiative

- Projects are expected to contribute to the New European Bauhaus initiative by interacting with the New European Bauhaus Community, NEBLab and other relevant actions of the initiative through sharing information, best practice, and, where relevant, results.
  In the context of this topic, geographical areas of the European Union and Associated Countries are NUTS level 1 regions of European Union Member States and of Associated Countries for which they are defined. In the case of Associated Countries without NUTS classification, the country as a whole is to be considered as one geographical area:

- List of Associated Countries not defined by NUTS level 1: Armenia; Bosnia and Herzegovina; Faroe Islands; Georgia; Kosovo;[168] Israel; Moldova; Tunisia; Ukraine.

- List of countries not defined by NUTS level 1 with which association negotiations are being processed or where association is imminent: Morocco.

Call - RESILIENT VALUE CHAINS 2024 TWO STAGE

HORIZON-CL4-2024-RESILIENCE-01-TWO-STAGE

[168] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

Conditions for the Call

Indicative budget(s)[169]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[170]	Indicative number of projects expected to be funded
		2024		
Opening: 19 Sep 2023 Deadline(s): 07 Feb 2024 (First Stage), 24 Sep 2024 (Second Stage)				
HORIZON-CL4-2024-RESILIENCE-01-35	IA	31.00	6.00 to 8.00	4
HORIZON-CL4-2024-RESILIENCE-01-36	IA	31.00	6.00 to 8.00	4
Overall indicative budget		62.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.

169 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

170 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Strategic innovation markets driven by advanced materials

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-RESILIENCE-01-35: Biodegradable polymers for sustainable packaging materials (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 31.00 million.
Type of Action	Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to start at TRL 4 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: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.

Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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 model of circularity-by-design and sustainable end-of-life (EoL) solutions for plastic 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 Ocean and Waters mission, to reduce the 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 at least four of the following activities**:

- Develop new, demonstrate and scale-up novel advanced bio-degradable polymer materials and 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.
- Develop 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.
- Scale up the production of packaging materials at pilot level.
- Identify and test 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. Model 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.

- Demonstrate 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 life cycle (including sourcing of feedstock).

Develop and demonstrate circular business model for production at industrial level, where the release of GHG emissions is; and assess significantly reduced; and assess the potential of secondary raw materials as a feedstock (including from renewable sources) for the production of bio-degradable polymers.

To enable a fast development of new advanced materials, digital tools, such as modelling and 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 (including machine learning).

The future Commission initiative 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).

HORIZON-CL4-2024-RESILIENCE-01-36: Advanced biomaterials for the Health Care (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 31.00 million.
Type of Action	Innovation Actions
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: Applicants submitting a proposal under the blind evaluation pilot (see General Annex F) must not disclose their organisation names, acronyms, logos, nor names of personnel in Part B of their first stage application (see General Annex E).
Technology Readiness Level	Activities are expected to start at TRL 3-4 achieve TRL 5-6 by the end of the project – see General Annex B.
Procedure	The procedure is described in General Annex F. The following exceptions apply: This topic is part of the blind evaluation pilot under which first stage proposals will be evaluated blindly.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [171].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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.

[171] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Projects are expected to contribute to the following outcomes:

- Develop the swiftly growing innovation market of medical applications, which is dependent on advanced biocompatible materials that can be printed or injected, including 4D materials that change their 3D structures following external impact (e.g. thermic, electric, mechanical or radiation treatment).
- 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 at least four of 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.
- Proposals shall demonstrate 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.
- Proposals shall address biomaterials with antibacterial properties contributing to the widespread bottleneck of antimicrobial resistance often encountered in clinical care
- Demonstrate the scaling of injectable hydrogels, including those made of nanocomposite, natural and synthetic polymer-based biomaterials, bone cements, bio-ceramics and electronics.
- The design for circularity has to develop, when relevant, bio-degradable or bio-absorbable biomaterials that are gradually eliminated by the body after fulfilling a purpose.

The biomaterials used 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.#

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 1 “Health” and Cluster 6 'Food, Bioeconomy, Natural Resources, Agriculture and Environment.

Improving the resilience of EU businesses, especially SMEs and Startups

Call - RESILIENT VALUE CHAINS 2024

HORIZON-CL4-2024-RESILIENCE-01

Conditions for the Call

Indicative budget(s)[172]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[173]	Indicative number of projects expected to be funded
		2024		
Opening: 19 Sep 2023 Deadline(s): 07 Feb 2024				
HORIZON-CL4-2024-RESILIENCE-01-01	RIA	20.00	Around 5.00	4
HORIZON-CL4-2024-RESILIENCE-01-04	IA	22.00	Around 7.30	3

[172] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[173] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

HORIZON-CL4-2024-RESILIENCE-01-08	IA	32.00	Around 16.00	2
HORIZON-CL4-2024-RESILIENCE-01-10	CSA	2.20	Around 2.20	1
HORIZON-CL4-2024-RESILIENCE-01-11	IA	15.00	Around 7.50	2
HORIZON-CL4-2024-RESILIENCE-01-24	IA	59.00	12.00 to 15.00	4
HORIZON-CL4-2024-RESILIENCE-01-41	CSA	10.00	Around 5.00	2
Overall indicative budget		160.20		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

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

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per	The Commission estimates that an EU contribution of around EUR 5.00 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal

project	requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 20.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. ** "African Union member states" includes countries whose membership has been temporarily suspended.*
Technology Readiness Level	Activities are expected to achieve TRL 3-5 by the end of the project – see General Annex B.

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[174] 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;

-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.[175]

-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.[176]

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, models of whole mineral systems related to critical raw materials, 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

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174 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

175 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1

176 COM (2020) 474

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 7.30 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 22.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which

	the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. ** "African Union member states" includes countries whose membership has been temporarily suspended.*
Technology Readiness Level	Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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[177] 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

[177] https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

in Europe in terms of social, environmental and economic performance.[178] Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[179]

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.

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, though joint processing of waste streams originating from end-of-life products recycling could be included and has to be duly justified.

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 deployment 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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178 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1

179 COM (2020) 474

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 16.00 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 32.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition

	systems will be ineligible. ** "African Union member states" includes countries whose membership has been temporarily suspended.*
Technology Readiness Level	Activities are expected to achieve TRL 6-7 by the end of the project – see General Annex B.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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[180] 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.[181]

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials[182] and the action plan on Rare Earth Magnets and Motors from the European Raw Materials Alliance[183].

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.

180 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en
181 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1
182 COM (2020) 474
183 https://erma.eu/european-call-for-action/

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 deployment 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-01-10: Addressing due diligence requirements in raw materials supply chains. (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 2.20 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 2.20 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply:

	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). 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. ** "African Union member states" includes countries whose membership has been temporarily suspended.*
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training

	Programme of the European Atomic Energy Community (2021-2025). [184].
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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[185] 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.[186]

Actions are expected to contribute to the implementation the EU action plan on Critical Raw Materials.[187]

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.

184 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

185 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en

186 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1

187 COM (2020) 474

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.

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 7.50 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 15.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). 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 Member States*, MERCOSUR, CARIFORUM, Andean Community and countries with which the EU has concluded strategic partnerships on raw materials. 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. Any activity aimed at deploying subliminal techniques beyond a person's consciousness, exploiting any of the vulnerabilities of a specific group of persons and at using emotion recognition systems will be ineligible. ** "African Union member states" includes countries whose membership has been temporarily suspended.*
Technology Readiness Level	Activities are expected to 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 the partners from the two partner countries mentioned in the scope below, grants will be awarded to applications in order of ranking but also to at least one project per each partner country, provided that the applications attain all thresholds.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [188].

[188] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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[189] for EU industrial value chains and strategic sectors.

Projects are expected to contribute to the following outcomes:

-Strengthen EU cooperation with resource rich countries;

-Provide new relevant life cycle inventory data sets based on requirements for Environmental Footprint compliant datasets[190] and in line with the 2021 Recommendation on the use of the Environmental Footprint methods[191], particularly focusing on the existing knowledge gaps (e.g., new technologies for open pit and underground mining).

-To evaluate the environmental performance of the technologies a Product Environmental Footprint (PEF) study will be produced.

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

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

-Improved 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.[192]

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 in resource 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.[193]

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

189 https://ec.europa.eu/growth/sectors/raw-materials/areas-specific-interest/critical-raw-materials_en
190 See JRC Guide_EF_DATA.pdf (europa.eu)
191 Commission Recommendation (EU) 2021/2279 of 15 December 2021 on the use of the Environmental Footprint methods to measure and communicate the life cycle environmental performance of products and organisations C/2021/9332, OJ L 471, 30.12.2021, p. 1–396
192 https://op.europa.eu/en/publication-detail/-/publication/6d541f66-0f81-11ec-9151-01aa75ed71a1
193 COM (2020) 474

and decarbonised extraction" in terms of industrial viability, safety and environmental impacts.

Actions are expected to 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.

Actions have to collaborate with Canada or Ukraine, following the strategic partnership on raw materials established in 2021 between the EU and Canada[194] and with Ukraine. [195] [196]. The consortia should contain raw materials industry from at least one of the partner countries and raw materials users from the EU. 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 deployment 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.

Safe and Sustainable by Design (SSbD) Chemicals and Materials

Proposals are invited against the following topic(s):

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

Specific conditions

194 https://ec.europa.eu/growth/news/eu-and-canada-set-strategic-partnership-raw-materials-2021-06-21_en

195 https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3633

196 The geographical scope of the topic may be revised before the call is launched, should new circumstances or priorities emerge

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 12.00 and 15.00 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 59.00 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.
Exceptional page limits to proposals/applications	In order to include a business case and exploitation strategy, the page limit in part B of the General Annexes is exceptionally extended by 3 pages.

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

- European industry will have access to safer and more sustainable innovative alternatives of chemicals and materials with reduced substitution barriers (e.g., performance, cost and supply demand);
- Industry will be able to test and demonstrate the applicability of the Safe and Sustainable by Design framework [197] to develop innovative chemicals or materials to substitute substances of concern [198];
- The EU climate ambitions [199] 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 EU strategies/policies and regulation, such as the proposal for the Ecodesign for Sustainable Products Regulation[200], the EU Ecolabel[201], REACH[202] or CLP[203] will be supported with safe and sustainable alternatives of chemicals and materials;

197 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

198 See Article 2 of the Proposal for a regulation of the European Parliament and of the Council establishing a framework for setting Ecodesign requirements for sustainable products and repealing Directive 2009/125/EC; https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

199 https://ec.europa.eu/clima/eu-action/european-green-deal/2030-climate-target-plan_en

200 https://ec.europa.eu/environment/publications/proposal-ecodesign-sustainable-products-regulation_en

201 https://ec.europa.eu/environment/ecolabel/the-ecolabel-scheme.html

202 https://ec.europa.eu/environment/chemicals/reach/reach_en.htm

203 https://echa.europa.eu/regulations/clp/legislation

- The proof of concept of developing new Safe and Sustainable by Design chemicals or materials will bring evidence for new skills needed to apply the Safe and Sustainable by Design framework;

- Market uptake of the Safe and Sustainable by Design chemicals and materials will be encouraged by citizens better understanding their benefits.

Scope: The Commission initiative for Safe and Sustainable by Design [204] sets a framework for assessing safety and sustainability of chemicals and materials and which should be considered as a reference in the proposal.

Proposals should develop one or more new chemical substances or materials to replace existing substances of concern with surfactant, flame retardant or plasticising functionalities for a chosen application. Proposals should address at least one industrial application. The new substances or materials shall be aligned with the Safe and Sustainable by Design framework, and demonstrate improved sustainability and a contribution to lower the impact on climate. The selected industrial application(s) should be in areas 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 the Safe and Sustainable by Design framework. The developed substances or materials will have to comply with the Safe and Sustainable by Design framework. Findings from the selected projects will be considered for the further refinement of the defined framework, if applicable;

- The selection of the chemical/materials to be developed should be justified with a technology and socio-economic analysis;

- Proposals should involve all relevant actors along the value chain;

- Identify the substitution barriers for the selected applications and propose a driving mechanism for a maximal 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) [205], where relevant;

- Interoperability for data sharing should be addressed across the entire value chain;

- Communication actions to all stakeholders and specifically citizens about the benefits of the developed Safe and Sustainable by Design chemicals and materials.

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204 See documents defining the SSbD framework on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

205 https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/sustainable-production-processes_en

Proposals should indicate to which chapters of the Strategic Research and Innovation Plan for chemicals and materials[206] they will contribute.

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, with projects resulting from the topic, HORIZON-CL4-2021-RESILIENCE-01-08 as well as other relevant projects from the topic HORIZON-CL6-2023-ZEROPOLLUTION. Proposals should allocate the necessary resources for collaboration with other relevant projects.

Synergies with Horizon Europe missions as relevant are encouraged.

Improving the resilience of EU businesses, especially SMEs and Startups

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 10.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). The following additional eligibility criteria apply: In order to achieve the expected objectives and/or the specific policy requirements of the

[206] https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

	topic, the applicant consortium must include at least three entities from at least three Member States or Associated Countries. Moreover, the same legal entity which have received funding under this topic in the 2021-22 work programme, will not be eligible to funding under the 2024 call, in addition geographical and sectorial complementarities in relation to the 2021-22 results will be considered for the 2024 call.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [207]. 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, which are underpinning the potential for competitive sustainability of SMEs.

[207] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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), 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.

Proposals can consider the involvement of the European Commission's Joint Research Centre as an associated partner providing its expertise in industrial innovation and dynamics.

Destination 3: World-leading Data and Computing Technologies

This destination will directly support the following Key Strategic Orientations (KSOs), as outlined in the Strategic Plan:

- KSO A, '**Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations.'

- KSO C, '**Making Europe the first digitally led circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems

Proposals for topics under this Destination should set out a credible pathway to contributing to the following expected impact of Cluster 4 as set out in Horizon Europe Strategic Plan:

- **Globally attractive, secure and dynamic data-agile economy**, by developing and enabling the uptake of the next-generation computing and data technologies and infrastructures (including space infrastructure and data), enabling the European single market for data with the corresponding data spaces and a trustworthy artificial intelligence ecosystem.

As data becomes the new fuel of the economy and a key asset to address our societal challenges, the EU cannot afford to have the data of its businesses, public sector and citizens stored and exploited largely outside its borders. This is affecting not only our economic performance but also our security, safety and sovereignty.

As announced in the EU data strategy (COM(2020) 66), the EU has the means to become the world's most secure and trustful data hub. For that to happen, an important investment effort in the development of data technologies is needed to support the use, interoperability and analytical exploitation of EU-wide common data spaces targeting essential economic sectors and areas of public interest. The COVID-19 crisis showed how essential it is to master data technologies to address our societal challenges and to incentivize public and private stakeholders to trustfully share data.

The investments should cover the necessary data infrastructure and service platforms to enable virtualisation, adaptation of data and meta-data (including standards for data sharing) as well as common analytics tools. Investment in this Destination will reinforce the cloud and data infrastructure supply industry and make data accessible to research, education, businesses and governments across the EU in a way that meets European values and requirements. It will focus on energy-efficient and trustworthy data infrastructures and related services. The EU also needs to swiftly develop generic cloud to edge to IoT technologies, methods, tools and platforms for the support of future hyper-distributed applications in any business/societal sector.

Europe's lead in the data economy also increasingly depends on its capability to autonomously develop key High Performance Computing (HPC) technologies, provide access to world-class supercomputing and data infrastructures, maintain global leadership in HPC applications, and foster the acquisition of HPC skills. This is the purpose of the activities funded by the EuroHPC Joint Undertaking.

Investments in this Destination contribute substantially to climate change objectives. Energy efficiency is a key design principle in actions, which will lead to new technologies and solutions that are cornerstones for a sustainable economy and society. These solutions range from environmentally sustainable data operations to balancing loads among centralised clouds and distributed edge computing, from decentralised energy sources to energy-harvesting sensors/devices, etc.

Finally, a robust data ecosystem rests as much on the wide, practical availability of top solutions and results, as on the transparency of the research and innovation process. To ensure trustworthiness and wide adoption by user communities for the benefit of society, actions should promote high standards of transparency and openness. Actions should ensure that the processes and outcomes of research and innovation align with the needs, values and expectations of society, in line with Responsible Research and Innovation.

This Destination is structured into the following headings, which group topics together with similar outcomes to address a common challenge:

- Data sharing and analytics capacity

As noted in Europe's Digital Decade Communication, the ability to process vast volumes data is one of the key enablers for other technological developments, supporting the competitiveness of the EU's industrial ecosystems. This is also an essential condition for the successful deployment of data spaces in several sectors as announced in the proposal for the 2030 Policy Programme "Path to the Digital Decade".

Data sharing and data interoperability are still at their infancy; few data markets for sharing industrial data exist. In a recent survey[208], more than 40% of the SMEs interviewed claim they had problems in acquiring data from other companies. The diffusion of platforms for data sharing and the availability of interoperable datasets is one of the key success factors which may help to drive the European data economy and industrial transformation. On the other hand, Europe is developing a strong legal framework for data and is well positioned to exploit data from the public sector. The potential of European industrial data (from digitising industry) creates great synergies to feed European data ecosystems with industrial, personal, and public sector data, to be shared and exploited in full compliance with the ethical and legal framework.

In line with the FAIR principles (Findable, Accessible, Interoperable and Reusable), the overall objective is to make Europe the most successful area in the world in terms of data

[208] https://ec.europa.eu/digital-single-market/en/news/sme-panel-consultation-b2b-data-sharing

sharing and data re-use while respecting the legal framework relating to security and privacy and fostering collaboration and building on existing initiatives.

In parallel, recent developments in sensor networks, cyber-physical systems, and the ubiquity of the Internet of Things (IoT) and Artificial Intelligence (AI) have increased the collection of data (including health care, social media, smart communities, industry, manufacturing, education, construction, agriculture, water management finance/insurance, tourism, education, and more) to an enormous scale (by 2025, 463 exabytes of data will be produced every day in the world). There is significant potential for advances of data analytics at the intersection of many scientific, technology and societal fields (e.g. data mining, AI, complex systems, network science, statistics, natural language understanding, mathematics, particle physics, astronomy, earth observation…), and new methods and approaches are needed along the whole data life-cycle and value chain.

The overall objective is to make the EU fully autonomous in processing, combining, modelling and analysing such large amounts of data for efficiently predicting future courses of action with high accuracy and advanced decision-making strategies. The use of natural resources is reduced and waste avoided by making it possible to replace classical experiments by data-driven digital models. The technological achievements under this heading will support the development of responsible and useful AI solutions, built on high-quality and high-value data.

- From Cloud to Edge to IoT for European Data

Recent intelligence and policy development like the 2030 Digital Decade target of 10.000 climate-neutral edge nodes further confirm the crucial role of next generation Cloud-Edge-IoT in Europe’s technological base. Moreover, they provide significant elements to guide the Research needs and priorities.

Today, 80% of the processing and analysis of data takes place in data centres and centralised computing facilities, and 20% in smart connected objects; only 1 European company in 4 use cloud technologies; 75% of the European cloud market is dominated by non-EU players. Considering the pace of development in this area outside of the EU, the implementation of the activities will require R&I instruments with great flexibility, including the support of SMEs and start-ups, to nurture a European ecosystem and deliver swift results.

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. Focus must be on the development and deployment of the next generation computing components, systems and platforms that enable this transition to a compute continuum with strong capacities at the edge and far edge in an energy efficient and trustworthy manner.

The overall objective of the topics in this heading is to establish the European supply and value chains in cloud to edge computing to Internet of Things (IoT) and tactile internet by integrating relevant elements of computing, connectivity, IoT, AI cybersecurity. New

cloud/edge technologies with enhanced performance enabled by AI will increase European autonomy in the data economy required to support future hyper-distributed applications.

Finally, actions on high-end computing for exascale performance and beyond will be entirely implemented in the Joint Undertaking EuroHPC.

The overall objective such actions is to ensure digital autonomy for Europe in key high-end supercomputing technology (hardware and software) and applications, and developing the first exascale supercomputer based predominantly on European technology by 2026.

Activities beyond R&I investments will be needed to realise the expected impacts: testing, experimentation, demonstration, and support for take-up using the capacities, infrastructures, and European Digital Innovation Hubs made available under the Digital Europe Programme; large-scale roll-out of innovative new technologies and solutions (e.g. interconnections between High-Performance Computing centres) via the Connecting Europe Facility; further development of skills and competencies via the European Institute of Innovation and Technology, in particular EIT Digital; upscaling of trainings via the European Social Fund +; and use of financial instruments under the InvestEU Fund for further commercialisation of R&I outcomes.

Expected impact

Proposals for topics under this Destination should set out a credible pathway to contributing to **world-leading data and computing technologies**, and more specifically to one or several of the following impacts:

- Improved European leadership in the global data economy
- Maximised social and economic benefits from the wider and more effective use of data

Reinforced Europe's ability to manage urgent societal challenges (e.g. data for crisis management, digital for clean).

Innovation Actions — Legal entities established in China are not eligible to participate in Innovation Actions in any capacity. Please refer to the Annex B of the General Annexes of this Work Programme for further details.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL4-2023-DATA-01	76.00		29 Mar 2023
HORIZON-CL4-2024-DATA-01		85.00	19 Mar 2024

Overall indicative budget	76.00	85.00	

Call - World leading data and computing technologies

HORIZON-CL4-2023-DATA-01

Conditions for the Call

Indicative budget(s)[209]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[210]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 29 Mar 2023				
HORIZON-CL4-2023-DATA-01-02	RIA	45.00 [211]	Around 9.00	5
HORIZON-CL4-2023-DATA-01-04	RIA	28.00 [212]	4.00 to 6.00	6
HORIZON-CL4-2023-DATA-01-06	CSA	2.00 [213]	Around 2.00	1
HORIZON-CL4-2023-DATA-01-07	CSA	1.00 [214]	Around 1.00	1
Overall indicative budget		76.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General

209 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

210 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

211 Of which EUR 15.75 million from the 'NGEU' Fund Source.

212 Of which EUR 11.20 million from the 'NGEU' Fund Source.

213 Of which EUR 0.70 million from the 'NGEU' Fund Source.

214 Of which EUR 0.35 million from the 'NGEU' Fund Source.

	Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Data sharing and analytics capacity

Proposals are invited against the following topic(s):

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 9.00 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 45.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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

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 [215] 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 European Strategy for Data[216] 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 the General Data Protection Regulation (GDPR)[217]. 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. To achieve this, proposals should consider multidisciplinary research and involve all necessary competences in the consortium.

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. Proposals should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed, in line with the European Interoperability Framework (EIF), and contributing to open, standardized and trusted federated concepts, enabling cross-domain data sharing and data markets.

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215 FAIR = Findable, Accessible, Interoperable, Re-usable
216 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0066
217 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016R0679

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

HORIZON-CL4-2023-DATA-01-07: Collaboration with NSF on fundamental research on new concepts for distributed computing and swarm intelligence (CSA)

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 1.00 million.
Type of Action	Coordination and Support Actions

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

- Support structure for EU-NSF cooperation: networking events, exchange and fellowship programmes, and vision workshops for the academic and industrial computing community, at least one annual EU-US workshop.

Scope: DG Connect and the relevant entity at US National Science Foundation (NSF) have identified mutual interest in collaborating on longer-term on fundamental research on new concepts for distributed computing and swarm intelligence. Preparing the grounds for cooperation, support is needed in terms of a landscaping analysis of relevant tools and frameworks in this field, with clearly identified mutual benefit, organising brokerage events for matching of on-going work streams in projects, especially linked to but not limited to the topic HE-CL4-2022-DATA-01-03 - Programming tools for decentralised intelligence and swarms, whilst promoting the emergence of open, collaborative programming frameworks and software development tools. Collaboration shall address common needs emerging on managing complexity through high levels of abstraction, in particular related to large numbers of distributed objects, evolving computational capacity at the edge, and on new AI-based concepts leading to self-organised, dynamic, and adaptive management..

Support for this collaboration is envisaged along the following lines:

• Yearly common workshops for exchange of research results organised in close collaboration with the HIPEAC CSA under Horizon Europe Cluster 4 “From Cloud-to-Edge-to-IoT for European Data”.

• Support to the collaboration through support for secretarial services, networking including travel, research exchange and fellowship programmes, promotion and brokerage events.

• NSF would provide supplement of funding to drive joint research and support collaboration.

Due to the current competitive position between world regions, for Europe it is critical here that collaboration should be based on pre-competitive work between research establishments and academic partners in the context of pairs of projects supported by NSF and the EU.

From Cloud to Edge to IoT for European Data

Proposals are invited against the following topic(s):

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

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 28.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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 exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [218].

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

[218] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Enhanced openness and open 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 should 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 be 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 Computing Continuum (IoT, Edge, Cloud,

Dataspaces) and HORIZON-CL3-2023-CS-01-02: Privacy-preserving and identity management 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, proposed solutions 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 Important Projects of Common European Interest (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-CL4-2023-DATA-01-06: Coordination and Support of Cognitive Computing Continuum research and policy (CSA)

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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

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

- Support structure for the European Computing ecosystem: networking events and vision workshops for the academic and industrial computing community.
- 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.
- Creation of a sustainable European forum of stakeholders representing the whole Cloud to Edge to IoT Computing research, industry and users from different domains/sectors.

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 and 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.

Call - World leading data and computing technologies

HORIZON-CL4-2024-DATA-01

Conditions for the Call

Indicative budget(s)[219]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[220]	Indicative number of projects expected to be funded
		2024		
Opening: 15 Nov 2023 Deadline(s): 19 Mar 2024				
HORIZON-CL4-2024-DATA-01-01	IA	38.00	8.00 to 10.00	4
HORIZON-CL4-2024-DATA-01-03	IA	45.00	20.00 to 25.00	2
HORIZON-CL4-2024-DATA-01-05	CSA	2.00	Around 2.00	1
Overall indicative budget		85.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.

219 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

220 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Data sharing and analytics capacity

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 8.00 and 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 38.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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. 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: 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[221], Data Governance Act[222], Data Act, Artificial Intelligence Act[223]) 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.

- Define, quantify and measure bias in data sets (especially those used for AI development).

- Shorten the time-to-market and reduce development costs of compliant data solutions

- Contribute to open, trusted and federated Common European data spaces.

- 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"[224].

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, improving energy reuse 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, bias detection, quality measurement, tracking of uses of data etc.), as well as design principles and architectures that are inherently compliant, addressing the relevant cybersecurity issues. Compliance should be understood in the broad sense, involving legal, ethical and environmental compliance. The competences represented in the consortium should cover all the relevant aspects (technical, legal, commercial, societal, ethical) appropriately.

The aim is to provide Common European data spaces[225] 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 and associate them with trustworthy AI techniques; protect privacy and confidentiality of AI training data and reduce energy footprint.

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221 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32016R0679

222 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32022R0868

223 The Data Act and the Artificial Intelligence Act are (at the time of writing this WP) at the stage of Commission legislative proposals. They are likely to be adopted by the closure of the call, and will appear in the Eur-lex repository of legislation.

224 See the communication "The European Green Deal" https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1576150542719&uri=COM%3A2019%3A640%3AFIN

225 As defined in the communication "A European strategy for data", see https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0066

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. Likewise, the proposed actions should create links and seek synergies, where appropriate, with the Common European Data Spaces and European Digital Innovation Hubs funded under the Digital Europe programme. Interoperability for data sharing should be addressed, where relevant, focusing on open, standardised, and trusted concepts.

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

From Cloud to Edge to IoT for European Data

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 20.00 and 25.00 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 45.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
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 which are

	not covered by higher-ranked proposals, provided that the proposals attain all thresholds:, 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.
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 to increase the innovation capacity of industry, in particular SMEs, through take-up and validation of emerging edge platform interfaces, in particular to foster edge solutions, which represent a modular functional spectrum of executable apps and services. The support to third parties can only be provided in the form of grants, for maximum of 20% of the requested EU contribution.. The maximum amount to be granted to each third party is EUR 200 000 in order to support industry, in particular SMEs, in take-up and validation of emerging edge platform interfaces, in particular to foster edge solutions, which represent a modular functional spectrum of executable apps and services.

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 open 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 renewable energy, buildings and electro-mobility, farming and/or industrial automation, including strategic aspects such as condition-monitoring/predictive maintenance and logistics, or other relevant application domains.

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.
- 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, et al.

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-DATA-01-05: Platform Building, standardisation and Up-scaling of the 'Cloud-Edge-IoT' Solutions (Horizontal Activities - CSA)

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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

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 should 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 should 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; such as KDT JU – explore links to INSIDE and EPOSS especially on Cyber Physical Systems and Smart Systems Integration.

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

Destination 4: Digital & Emerging Technologies for Competitiveness and Fit for the Green Deal

This destination will directly support the following Key Strategic Orientations (KSOs), as outlined in the Strategic Plan:

- KSO A, '**Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations.'

- KSO C, '**Making Europe the first digitally led circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems

Proposals for topics under this Destination should set out a credible pathway to contributing to the following expected impact:

- **Open strategic autonomy in digital technologies and in future emerging enabling technologies**, by strengthening European capacities in key parts of digital and future supply chains, allowing agile responses to urgent needs, and by investing in early discovery and industrial uptake of new technologies.

Electronic and photonic components, and the software that defines how they work, are the key digital technologies that underpin all digital systems. As the digitalisation of all sectors accelerates, most industries depend on early access to digital components. Dependence on these technologies represents a clear threat to Europe's autonomy, particularly in periods of geopolitical instability, exposing Europe to risks of vulnerability. Actions under this Destination will build on EU strengths in low-power consumption and ultra-secure components, Europe needs to develop the essential electronic and photonic components for a wide range of applications such as healthcare equipment, electric and autonomous vehicles, manufacturing and production plants and equipment, telecom networks, aerospace vehicles, consumer products

R&I initiatives on 6G technologies are now starting in leading regions world-wide, with the first products and infrastructures expected for the end of this decade. 6G systems are expected to offer a new step change in performance from Gigabit towards Terabit capacities and sub-millisecond response times, to enable new critical applications such as real-time automation or eXtended Reality ("Internet of Senses"). Europe must engage now to be among the top influencers of - and competitors in - these technologies and ensure that emerging network technology standards are defined following European values and energy-efficiency requirements. Main actions on 6G technologies will be undertaken in the Smart Networks and Services Joint Undertaking.

Despite a strong European scientific community's on AI and robotics, Europe lags behind in AI diffusion. Actions under this Destination will develop world-class technologies serving the needs of all types of European industries (e.g. manufacturing, healthcare, transport, agriculture, energy, construction), providing top-performing solutions that businesses will trust and adopt to maintain their competitiveness and maximise their contribution to environmental sustainability.

While Europe is strong in many sectors, it must take ownership of its unavoidable future transformations for competitiveness, prosperity and sustainability, by early leadership in new and emerging enabling technologies, e.g. alternative computing models such as bio- and neuro-morphic approaches, use of biological elements as part of technology, and sustainable smart materials. In particular, the far-reaching impact of quantum and graphene technologies on our economy and society cannot be fully estimated yet, but they will be disruptive for many fields. Actions in this Destination will ensure that Europe stays ahead in this global race and is in a position to achieve game-changing breakthroughs.

In line with the vision set out in the Digital Decade Communication (COM(2021)118), in particular its 'secure and performant sustainable digital infrastructures' pillar, actions under this Destination will support Europe's open strategic autonomy, and reinforce and regain European industry's leaderships across the digital supply chain. It will direct investments to activities that will ensure a robust European industrial and technology presence in all key parts of a greener digital supply chain, from low-power components to advanced systems, future networks, new data technologies and platforms. Autonomy will require sustaining first-mover advantage in strategic areas like quantum computing and graphene, and investing early in emerging enabling technologies.

Investments in this Destination contribute substantially to climate change objectives. Energy efficiency is a key design principle in actions, which will lead to new technologies and solutions that are cornerstones for a sustainable economy and society. These solutions range from ultra-low-power processors to AI, Data and Robotics solutions for resource optimisation and reduction of energy consumption and CO2 emissions; from highly efficient optical networking technologies and ultra-low-energy 6G communication networks to robotics that overcome the limitation of energy autonomy. Furthermore, promising emerging avenues are addressed via ultra-low power operations enabled by spintronics and 2D materials-based devices and systems for energy storage and harvesting.

Actions should devote particular attention to openness of the solutions and results, and transparency of the research and innovation process. To ensure trustworthiness and wide adoption by user communities for the benefit of society, actions should promote high standards of transparency and openness. Actions should ensure that the processes and outcomes of research and innovation align with the needs, values and expectations of society, in line with Responsible Research and Innovation.

As a result, this Destination is structured into the following headings, which group topics together with similar outcomes to address a common challenge:

- European Innovation Leadership in Photonics

The European photonics industry has an excellent position in core segments, far above the average EU market share. The objective of the topics grouped in this heading is to strengthen current leadership in photonic technologies and applications, and to secure access in Europe to cutting-edge photonic technologies.

The topics of this heading are under the co-programmed Partnership 'Photonics'.

- AI, Data and Robotics

Europe has an outstanding track record in key areas of AI research, Europe's scientific community is leading in AI and robotics, but substantial efforts are needed to transform this into (disruptive) European AI technology products that can withstand international competitors. Europe also lags behind in technology diffusion, less than half of European firms have adopted AI technology, with a majority of those still in the pilot stage. 70% of these adopter companies, only capture 10% of full potential use, and only 2% percent of European firms in healthcare are using those technologies at 80% of potential [226]. Moreover, as demonstrated during the COVID-19 crisis, many AI, Data and Robotics solutions exist today but only a limited number of them reaches the level of maturity and adoption necessary to solve the problems at hand. Therefore, there is room for improved adoption by industry, which requires a drastic increase of industry-driven R&I, from basic research to large-scale piloting. In general, industry acknowledges the potential of AI technologies, but often lacks demonstrable benefits for their particular use cases.

The objective of this heading is to ensure autonomy for Europe in AI, data and robotics in developing world-class technologies serving the needs of all types of European industries, from manufacturing to healthcare, public sector, utilities, retail, finance, insurance, transport, agriculture, energy, telecommunications, environmental monitoring, construction, media, creative and cultural industries, fashion, tourism, etc. providing top-performing solutions that industries will trust and adopt to maintain their competitiveness and maximise their contribution to environmental and resources sustainability.

Several topics of this heading are under the co-programmed Partnership 'AI, Data and Robotics'.

When it comes to Robotics, Europe is leading in its industry, with a high intensity of use of robots. Europe is also scientifically leading in robotics' cognition, safety, manipulation, soft robotics, underwater and aerial robotics, with demonstrated impacts in many use-cases in key industrial sectors (e.g.: healthcare, agri-food [227], forestry, inspection and maintenance, logistics, construction, manufacturing, etc.) and across multiple modalities (aerial, marine, ground, in-vivo and space).

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226 See https://www.mckinsey.com/featured-insights/artificial-intelligence/tackling-europes-gap-in-digital-and-ai (based on data from 2017 and 2018)

227 The term Agri-Food is intended to cover a wide range of food production sectors including livestock farming, fisheries, horticulture etc., as well as produce processing, ingredient preparation and food manufacture and assembly.

The objective of this heading is to ensure autonomy for Europe in robotics, leading the way in research, development and deployment of world-class technologies.

Several topics of this heading are under the co-programmed Partnership 'AI, Data and Robotics'.

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

The European strategy for data (COM(2020) 66) aims at creating a single market that will ensure Europe's global competitiveness and data sovereignty. This calls for the ability to handle the entire data life-cycle which in turn relies on the underlying computing infrastructure (from the hardware to the software).

In the light of dominant players, bridging established computing models (High Performance Computing, Cloud Computing, edge-computing and other emerging computing architectures) becomes a critical success factor for enabling a computing continuum. Open computing architectures at many levels based on Open approaches spanning both software/hardware is thus a pre-requisite for Digital autonomy – notably when it comes to Cloud infrastructures where European players are falling short.

Actions under this heading will thus support the next steps of development and adoption of Open technologies on different levels while fostering progress on responsible software engineering fundamentals.

- European leadership in Emerging and Enabling Technologies

Europe's leading industry sectors have a solid track-record in constant improvement, but less so for embracing transformative ideas. The pathway from research to industry uptake is often long and staged, with no intertwining of research and industry agendas. In the age of deep-tech, though, this intertwining is essential.

The objective of this heading is to identify early technologies that have the potential to become Europe's future leading technologies in all areas of this cluster and to establish industry leadership in these technologies from the outset. This heading has a unique focus on off-roadmap transformations with a longer time-horizon but profound potential impact.

- Flagship on Quantum Technologies: a Paradigm Shift

Since 2018, the Quantum Technologies Flagship has been consolidating and expanding Europe's scientific leadership and excellence in quantum, in order to foster the development of a competitive quantum industrial and research ecosystem in Europe. The EU's aims for quantum R&I in the next decade are set out in detail in the Quantum Flagship's Strategic Research Agenda (SRA[228]) and its associated main Key Performance Indicators,[229] which drafted and published in 2020 on quantum computing, quantum simulation, quantum

[228] https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=65402
[229] Link to provide later

communication, and quantum sensing and metrology. Projects in each of these areas are currently supported by the Flagship, by other EU research initiatives and by national programmes.

The objective of this heading is to further develop quantum technologies and their applications in the areas of quantum computing, simulation, sensing and communication, in order to strengthen European technological sovereignty in this strategic field and achieve first-mover industry leadership, capitalising on Europe's established excellence in quantum science and technology maintaining and developing quantum competences and skills available in the EU and raising the capabilities of all Member States in this field.

The aim of the Commission's Digital Decade strategy is for the EU to become digitally sovereign in an interconnected world, and in the coming years quantum technologies will be a key element of this digital sovereignty, as they are of global strategic importance. Quantum technologies will be also used, among others, for sensitive applications in the area of security, and in dual-use applications. Other world regions are already investing heavily in all areas of quantum technologies research. In this context, the EU must 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. This will enable it to safeguard its strategic assets, interests, autonomy and security, while advancing towards its goal of open strategic autonomy.

The Quantum Technologies Flagship conducts research and development activities in the key domains of quantum computing and simulation, quantum communication, and quantum sensing. The Flagship will contribute to world-leading quantum computers and simulators, that will be acquired by the European High Performance Computing Joint Undertaking, and will be crucial to achieving its Digital Decade goal of having its first computer with quantum acceleration by 2025, with a view to being at the cutting edge of quantum capabilities by 2030. These machines will have a profound impact, with applications in medicine, manufacturing, or new material and new drugs design but also in cryptography, finance and many other sensitive domains.

Research in quantum sensing technologies is also vital to the EU's interests, as it will develop European expertise in quantum clocks for navigation (including for embarkation on Galileo satellites) and precise timing applications, sensors for autonomous vehicles, and the next generation of medical sensors.

It is therefore clearly in the EU's interests to protect European research in these domains, the intellectual property that it generates, and the strategic assets that will be developed as a result, while taking steps to avoid situations of technological dependency on non-EU sources (in line with the call of the October 2020 European Council to reduce Europe's strategic dependencies). With this in mind, the Commission has decided that, in the research areas covered by 6 actions in this work programme in quantum computing and simulation, communication, and sensing, only Associated Countries that meet certain conditions will be eligible to participate in these actions.

The eligibility to participate in such actions is limited to specific entities as specified in the relevant topics.

- Graphene: Europe in the lead

The starting point is the Graphene Flagship, launched in 2013, which already reached European leadership in graphene and related 2D materials. The work is now coming to a critical point where first simple products are being launched. R&I activities would now need to be pursued and accelerated in order to translate achieved technology advances that are at TRL 3-5 into concrete innovation opportunities and into production capabilities in many industrial sectors (e.g. aviation, automotive, electronics, batteries, healthcare).

The objective of this heading is to strengthen and accelerate the technology developments that support a strong European supply and value chain in graphene and related materials and provide first-mover market advantages of scale.

Activities beyond R&I investments will be needed to realise the expected impacts: testing, experimentation, demonstration, and support for take-up using the capacities, infrastructures, and European Digital Innovation Hubs made available under the Digital Europe Programme; large-scale roll-out of innovative new technologies and solutions (e.g. new energy-efficient connectivity technologies) via the Connecting Europe Facility; further development of skills and competencies via the European Institute of Innovation and Technology, in particular EIT Digital; upscaling of trainings via the European Social Fund +; and use of financial instruments under the InvestEU Fund for further commercialisation of R&I outcomes.

Expected impact

Proposals for topics under this Destination should set out a credible pathway to contributing to **digital and emerging technologies for competitiveness and fit for the Green Deal**, and more specifically to one or several of the following impacts:

- Europe’s open strategic autonomy by sustaining first-mover advantages in strategic areas including AI, data, robotics, quantum computing, and graphene, and by investing early in emerging enabling technologies.
- Reinforced European industry leadership across the digital supply chain.
- Robust European industrial and technology presence in all key parts of a greener digital supply chain, from low-power components to advanced systems, future networks, new data technologies and platforms.

Innovation Actions — Legal entities established in China are not eligible to participate in Innovation Actions in any capacity. Please refer to the Annex B of the General Annexes of this Work Programme for further details.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL4-2023-DIGITAL-EMERGING-01	108.00		29 Mar 2023
HORIZON-CL4-2023-DIGITAL-EMERGING-01-CNECT	129.00		29 Mar 2023
HORIZON-CL4-2024-DIGITAL-EMERGING-01		136.50	19 Mar 2024
HORIZON-CL4-2024-DIGITAL-EMERGING-01-CNECT		88.00	19 Mar 2024
Overall indicative budget	237.00	224.50	

Call - Digital and emerging technologies for competitiveness and fit for the Green Deal

HORIZON-CL4-2023-DIGITAL-EMERGING-01

Conditions for the Call

Indicative budget(s)[230]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[231]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 29 Mar 2023				
HORIZON-CL4-2023-DIGITAL-EMERGING-01-01	RIA	30.00 [232]	Around 8.00	4
HORIZON-CL4-2023-DIGITAL-EMERGING-01-12	RIA	22.00	5.00 to 7.00	4
HORIZON-CL4-2023-DIGITAL-EMERGING-01-51	RIA	18.00 [233]	3.00 to 5.00	4
HORIZON-CL4-2023-DIGITAL-EMERGING-01-53	RIA	18.00 [234]	3.00 to 5.00	4
HORIZON-CL4-2023-DIGITAL-EMERGING-01-57	IA	20.00 [235]	5.00 to 7.00	4
Overall indicative budget		108.00		

230 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

231 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

232 Of which EUR 10.50 million from the 'NGEU' Fund Source.

233 Of which EUR 7.20 million from the 'NGEU' Fund Source.

234 Of which EUR 7.20 million from the 'NGEU' Fund Source.

235 Of which EUR 8.00 million from the 'NGEU' Fund Source.

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

AI, Data and Robotics (incl. efficient, robust, safe, adaptive and trusted robots)

Proposals are invited against the following topic(s):

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

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 30.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

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 where robotics has the potential to deliver significant economic and/or societal benefits. This next step autonomy should clearly delineate from state of the art solutions and can be illustrated by the following non-exhaustive examples[236]:

  - 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 renewable energy installations such as wind turbines, photovoltaic farms, or in the maintenance of city infrastructure such as wastewater systems or road and rail infrastructures).

  - 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 during task execution. Robotic manipulation systems should target speed and dexterity with respect to a wide range of different objects and materials.

Projects are also expected to contribute to the following additional outcomes:

- Deliver a step change in autonomy essential for the diffusion of robots in various industries, sectors and services which can;

[236] In these descriptions the word adapt is used in a general sense and refers to the alteration of behaviours and goals by any means.

- interact safely and smoothly to support humans in their daily activities, based on strong multidisciplinary approach, including the relevant Social Science and Humanities (SSH) dimension,
- 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,
- address human and work interaction in high impact sectors under realistic conditions.

- Accelerate enabling conditions essential for the diffusion of robots in various industries, sectors and services.

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 society by contributing to addressing major societal and economic 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. 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 the interdependence between safety, security and system performance with respect to the chosen application or use case.

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 collaborative robots

Multidisciplinary research activities should address all of the following:

- Proposals should involve appropriate expertise in all relevant disciplines. Social Sciences and Humanities (SSH) is particularly relevant in addressing aspects related to 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 should bear 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.

European Leadership in Emerging and Enabling Technologies

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-DIGITAL-EMERGING-01-12: Adaptive multi-scale modelling and characterisation suites from lab to production (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 7.00 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 22.00 million.
Type of Action	Research and Innovation Actions
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.

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

- Enable industry to more effectively develop new and work with existing advanced materials by building on digitally integrated and validated modelling and characterisation methods for enhanced materials knowledge 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 an integrated European materials platform,[237] 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: 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's open strategic autonomy throughout value chains (and covering all aspects of sustainability). 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.

The development of novel advanced materials requires a wide and complex range of trusted information on materials and process behaviour, along the entire life-cycle 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 industry to establish trust 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, integrated 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 integrated methodologies of 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;

237 https://ec.europa.eu/info/sites/default/files/research_and_innovation/research_by_area/documents/advanced-materials-2030-manifesto.pdf

- develop complex structure-property correlations in advanced materials;
- ensure complete coverage of conditions in industrial environments.

- Integrate modelling and characterisation, in particular by
  - Developing modelling methods that provide the capabilities to virtually characterise materials and enhance the interpretation of the results of particular characterisation methods in order to guide and refine experiments;
  - Developing 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[238]).
- Demonstrate the functionality of the suites for the development of certain advanced materials for the green transition.
- Validate the methodologies and provide benchmarks, i.e. clear documentation of capabilities that can serve as a standard point of reference for industrial application.

Research should build on existing standards or contribute to standardisation. Documentation and interoperability for data sharing should be addressed, based on the OntoCommons EcoSystem (OCES).

Projects should build on and seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms. In particular, projects funded under this call should collaborate under the umbrella of the EMMC and EMCC and interact closely with topic HORIZON-CL4-2023-RESILIENCE-01-39 (CSA).

European Innovation Leadership in Photonics

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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.

238 https://www.cencenelec.eu/media/CEN-CENELEC/CWAs/RI/cwa17284_2018.pdf

Indicative budget	The total indicative budget for the topic is EUR 18.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

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

Improved key metrics for communications (speed, power consumption, density) or for sensing (sensitivity, compactness, power consumption), making photonics ubiquitous in digital systems

New photonic-enabled sensing functions, not feasible with a technology platform based on a single material, or computing paradigms enabling new systems architectures (e.g. neuromorphic computing)

Vital contribution to Technological Sovereignty, Green Deal, Digital Transformation or Competitiveness which demonstrates new functionality, higher performance and more cost-effective systems across multiple application domains

Maintaining European technology leadership in the face of strong global competition

Scope: Proposals should address one of the following areas of activities:

- Co-integration of photonics and microelectronics on single or multiple die (‘chiplet’ approach)
- Co-integration of multiple photonic IC material systems or components to address new wavelengths and sensor functions or new computing paradigms

Proposals should demonstrate at least two use cases linked to commercial applications for example in computing, communications, robotic and autonomous systems, sensors or Internet of Things.

This topic implements the co-programmed European Partnership Photonics.

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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 18.00 million.
Type of Action	Research and Innovation Actions
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 exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [239].

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

- Outcome 1: Increased manufacturing productivity or increased quality and speed of diagnosis results;
- Outcome 2: Increased accuracy and/or reduced feature size in microelectronics production including packaging for the integration of photonic and electronic functionalities on chips;
- Outcome 3: Increased specificity of diagnosis of human tissue, specific single cells, or molecular biomarkers in body liquids.

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

[239] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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 flexible pulse shapes, repetition rates and intensities (cw down to fs and bursts);
- Miniaturized light sources and lasers employing photonic integrated circuit technology
- Versatility by spectral tuneability, coherence and multi-wavelength emission;
- 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-CL4-2023-DIGITAL-EMERGING-01-57: Advanced imaging and sensing technologies (IA)(Photonics Partnership)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 7.00 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 20.00 million.
Type of Action	Innovation Actions
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. The following exceptions apply: The funding rate is up to 60% of the eligible costs. This funding rate applies to both 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.

	Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [240].

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

It should 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;
- Safety and security, where fast reconnaissance and identification of collaborative or non-collaborative targets and surveillance of infrastructures are required;
- Industry, where imaging can be used for logistics and inspection and analysis of safety and quality control of processes or produced goods;
- Health, where minimally and non-invasive spectroscopic and biophotonic imaging and sensing techniques enable diagnosis, screening, monitoring and treatment of a patient, possibly including augmented reality (AR) visualization;
- Agriculture and food, where spectroscopic imaging and sensing 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

[240] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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 are encouraged, such as:

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

This topic implements the co-programmed European Partnership Photonics.

Call - Digital and emerging technologies for competitiveness and fit for the Green Deal

HORIZON-CL4-2023-DIGITAL-EMERGING-01-CNECT

Conditions for the Call

Indicative budget(s)[241]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[242]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 29 Mar 2023				
HORIZON-CL4-2023-DIGITAL-EMERGING-01-02	IA	30.00 [243]	Around 10.00	3
HORIZON-CL4-2023-DIGITAL-EMERGING-01-11	RIA	35.00	3.00 to 4.00	10
HORIZON-CL4-2023-DIGITAL-	RIA	6.00 [244]	3.00 to 5.00	2

241 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

242 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

243 Of which EUR 10.50 million from the 'NGEU' Fund Source.

EMERGING-01-32				
HORIZON-CL4-2023-DIGITAL-EMERGING-01-33	RIA	12.00 [245]	3.00 to 4.00	3
HORIZON-CL4-2023-DIGITAL-EMERGING-01-40	RIA	12.00 [246]	4.00 to 6.00	2
HORIZON-CL4-2023-DIGITAL-EMERGING-01-41	RIA	20.00 [247]	7.00 to 12.00	2
HORIZON-CL4-2023-DIGITAL-EMERGING-01-43	FPA			0
HORIZON-CL4-2023-DIGITAL-EMERGING-01-50	RIA	10.00 [248]	2.00 to 3.00	3
HORIZON-CL4-2023-DIGITAL-EMERGING-01-56	CSA	4.00 [249]	1.00 to 3.00	2
Overall indicative budget		129.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant	The rules are described in General Annex G.

244 Of which EUR 2.10 million from the 'NGEU' Fund Source.
245 Of which EUR 4.20 million from the 'NGEU' Fund Source.
246 Of which EUR 4.20 million from the 'NGEU' Fund Source.
247 Of which EUR 7.00 million from the 'NGEU' Fund Source.
248 Of which EUR 3.50 million from the 'NGEU' Fund Source.
249 Of which EUR 1.40 million from the 'NGEU' Fund Source.

Agreements	

AI, Data and Robotics (incl. efficient, robust, safe, adaptive and trusted robots)

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-DIGITAL-EMERGING-01-02: Industrial leadership in AI, Data and Robotics – advanced human robot interaction (AI Data and Robotics Partnership) (IA)

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 30.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio coverage, grants will be awarded to applications not only in order of ranking but at least also to the highest ranked proposal for each of the two expected scopes (1. Development of innovative solutions to address major application-driven challenges, 2. Large scale pilots bringing major industries from key application sectors in Europe). Proposals should clearly identify the scope it will focus on.
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.

	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.

Expected Outcome: Projects are expected to contribute to all 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.

Scope: 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 start-ups 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 also aims 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 development of robust middleware that can be deployed in service and industrial applications and to expand the number and variety of high quality sharable industrially deployable modules related to human robot interaction at all levels, fostering the widespread deployment of such technologies in the targeted application sector and beyond.

Financial Support to Third Parties: Projects should use FSTP to stimulate the engagement of SMEs in the delivery of high quality, robust, sharable modules for use in human robot interaction in service and industrial tasks. Minimum 50% of the EU funding requested by the proposal should be allocated to the purpose of financial support to third parties.

- 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, systems, sub-systems and solutions in various use-cases/sectors where human robot interaction is a critical necessity. Pilots should show scalability/versatility, and enable economies of scale.

Financial Support to Third Parties: Projects may involve FSTP in order to stimulate the engagement of SMEs in testing and validating innovative solutions in the pilots. A maximum of 50% of the EU funding requested by the proposal may be allocated to the purpose of financial support to third parties.

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 should involve the relevant expertise to address the human factors aspects of robot human collaboration at all levels of interaction.

Proposals should clearly delineate the expected contributions from the main beneficiaries as well as from the third parties, to ensure their coherence and impact.

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 should include a clear business case and exploitation strategy.

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 by using appropriate models of human robot interaction.

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.

European Leadership in Emerging and Enabling Technologies

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-DIGITAL-EMERGING-01-11: Low TRL research in micro-electronics and integration technologies for industrial solutions (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 4.00 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 35.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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 Outcome: 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[250] 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 of multiple functions such as communication (RF, mmW or THz), sensing, actuating, power management and 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.

Graphene and 2D materials: Europe in the lead

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-DIGITAL-EMERGING-01-32: Sustainable safe-by-design 2D materials technology (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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 6.00 million.

[250] Alternative to mainstream Silicon CMOS technologies

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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [251].

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

- Development of Safe and Sustainable by Design two-dimensional materials (2DM) technology.
- Societal acceptance of 2DM and 2DM-based technologies.
- A set of robust and verified assays for toxicity and eco-toxicity testing of 2DM, to support regulatory requirements for their registration and authorisation for use (OECD test guidelines[252], REACH compliance, authorisation pathways[253])

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[254] 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.

[251] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[252] https://www.oecd.org/chemicalsafety/testing/oecd-guidelines-testing-chemicals-related-documents.htm

[253] https://echa.europa.eu/en/regulations/reach/registration

[254] See documents defining the SSbD framework and criteria on: https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/key-enabling-technologies/advanced-materials-and-chemicals_en

- Studies and tests of biocompatibility and safety of 2DMs and composites along their life cycle;
- 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. In particular projects are expected to develop synergies and relate to activities and outcomes of the projects selected under the other topics of 'Graphene and 2D materials: Europe in the lead' and where relevant of HORIZON-CL4-2023-RESILIENCE-01-21/22/23/24.

Proposals should also cover the contribution to the governance and overall coordination of the Graphene Flagship initiative.

Proposals should indicate which chapters of the Strategic Research and Innovation Plan for chemicals and materials they will contribute to.

Proposals should consider involving, directly or indirectly, appropriate expertise in other disciplines, for example in SSH disciplines, where relevant to achieve wider societal acceptance of 2DM-based technologies.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-33: 2D materials of tomorrow (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 4.00 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 12.00 million.
Type of Action	Research and Innovation Actions

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.

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

A broad portfolio of innovative two-dimensional 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. In particular, projects are expected to develop synergies and relate to activities and outcomes of the projects selected under the other topics of ‘Graphene and 2D materials: Europe in the lead’.

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.

Flagship on Quantum Technologies: a Paradigm Shift

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-DIGITAL-EMERGING-01-40: Quantum Photonic Integrated Circuit technologies (RIA)

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 12.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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 and the following additional associated country: Israel[255]. 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 [256]

255 Legal entities established in Israel are eligible to participate in this action on the basis that (i) Israel is an associated country (and continues to be on the date of the opening of this topic for submission); and (ii) Israel meets specific conditions. Prior to the adoption of this Work Programme, questionnaires were sent to non-EEA associated countries and countries in the process of association in order to assess their eligibility to participate.

256 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;

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 exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [257].

Expected Outcome: 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, reliable, cost-effective components, that will enable quantum technology to be introduced in the market.

Expected Outcome:

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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.

257 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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, packaging.

- 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, quantum processors.

- 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, Al2O3, AlN, 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.

HORIZON-CL4-2023-DIGITAL-EMERGING-01-41: Investing in alternative quantum computation and simulation platform technologies (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 7.00 and 12.00 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 20.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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 and the following additional

	associated country: Israel[258]. 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 [259]
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.

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. Breakthroughs in scalability need to be achieved along with breakthroughs in fidelity.

The development of alternative quantum computer and simulator systems and platforms, based for example on photonic or nitrogen vacancy-centre platforms or hybrid systems, 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

[258] Legal entities established in Israel are eligible to participate in this action on the basis that (i) Israel is an associated country (and continues to be on the date of the opening of this topic for submission); and (ii) Israel meets specific conditions. Prior to the adoption of this Work Programme, questionnaires were sent to non-EEA associated countries and countries in the process of association in order to assess their eligibility to participate.

[259] 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.

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. Cooperation with the 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), and future Digital Europe Programme EuroHPC JU calls for acquisition and operation of quantum computers, and their integration with the HPC and data infrastructure, including also the need to establish from the beginning of this cooperation appropriate IP exploitation agreements;

2. Cooperation and coordination with the Flagship initiatives supporting the establishing of key European fabrication processes, technologies and supply chain for the proposed platform, including the FPA(s) funded under HORIZON-CL4-2021-DIGITAL-EMERGING-02-17 and HORIZON-CL4-2021-DIGITAL-EMERGING-02-15 and their respective SGA(s).

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 EU 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-CL4-2023-DIGITAL-EMERGING-01-43: Framework Partnership Agreement for developing large-scale quantum Computing platform technologies (FPA)

Specific conditions	
Type of Action	Framework Partnership Agreement
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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 and the following additional associated country: Israel[260]. 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 [261]
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.

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.

260 Legal entities established in Israel are eligible to participate in this action on the basis that (i) Israel is an associated country (and continues to be on the date of the opening of this topic for submission); and (ii) Israel meets specific conditions. Prior to the adoption of this Work Programme, questionnaires were sent to non-EEA associated countries and countries in the process of association in order to assess their eligibility to participate.

261 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.

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:

- Demonstrate a universally programmable processor of at least 200 physical qubits (by 2027) operating in the NISQ 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.

- 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.

- 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 and maintenance 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 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 should 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 the development and integration in this platform of 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), and DEP Future EuroHPC JU Calls for acquisition and operation of Quantum computers, and their integration with the HPC and data infrastructure, 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-CL4-2023-DIGITAL-EMERGING-01-50: Next generation quantum sensing and metrology technologies (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.00 and 3.00 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 10.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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 and Mercosur 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 security[262].
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.

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 application 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, point-defects in the solid-state (bulk or 2D materials). They are expected to provide extreme precision and accuracy measurements in many fields, beyond the performance of consumer devices and services, in applications such as for example medical diagnostics and imaging, quantum enhanced spectroscopy and imaging, entangled clocks, inertial sensors, high and quantum opto-mechanical sensing devices, radio-frequency sensing, 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, hybrid

[262] 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.

superconducting-magnetic / sensing devices, quantum imaging for material science and microelectronics.

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.

European Innovation Leadership in Photonics

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.00 and 3.00 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 4.00 million.
Type of Action	Coordination and Support Actions
Procedure	The procedure is described in General Annex F. The following

	exceptions apply: To ensure a balanced portfolio covering both activity 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 activity area, provided that the applications attain all thresholds.

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

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

Scope: Two types of proposals are expected.

Type 1: Supporting the industrial strategy for photonics in Europe (EU contribution around 3 million EUR)**.** 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.

Type 2: Fostering careers in photonics (EU contribution around 1 million EUR)**.** 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. Action should seek synergies with the skills development activities called for in the Digital Europe programme and with the activities on strategy development called for under type 1.

This topic implements the co-programmed European Partnership Photonics.

Call - Digital and emerging technologies for competitiveness and fit for the Green Deal

HORIZON-CL4-2024-DIGITAL-EMERGING-01

Conditions for the Call

Indicative budget(s)[263]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[264]	Indicative number of projects expected to be funded
		2024		
Opening: 15 Nov 2023 Deadline(s): 19 Mar 2024				
HORIZON-CL4-2024-DIGITAL-EMERGING-01-03	RIA	30.00	Around 8.00	4
HORIZON-CL4-2024-DIGITAL-EMERGING-01-04	IA	60.00	Around 10.00	5
HORIZON-CL4-2024-DIGITAL-EMERGING-01-22	RIA	13.50	4.00 to 6.00	4
HORIZON-CL4-2024-DIGITAL-EMERGING-01-54	RIA	18.00	3.00 to 5.00	4
HORIZON-CL4-2024-DIGITAL-EMERGING-01-55	IA	15.00	Around 15.00	1
Overall indicative budget		136.50		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.

263 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

264 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

AI, Data and Robotics (incl. efficient, robust, safe, adaptive and trusted robots)

Proposals are invited against the following topic(s):

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)

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 30.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

Expected Outcome: Projects are expected to contribute to all of the following primary outcomes:

- Achieve the substantial next step in the ability of robots to perform non-repetitive functional tasks in realistic settings, based on underlying robot functions (e.g. guidance/navigation/manipulation/interaction etc.), demonstrated in key high impact sectors where robotics has the potential to deliver significant economic and/or societal benefits. This next step functionality should clearly delineate from state of the art solutions and can be illustrated by the following non-exhaustive examples that illustrate different types of functional ability. Proposals should address functional challenges that are of equivalent or greater complexity and/or combine different types of functions to deliver greater functional complexity:

    - To reach the point where the robot systems operating in harsh complex and dynamic working environments can carry out sequences of complex functions to achieve a functional goal.

    - For example a robot able to carry out a range of different types of functions where the choice and sequence of execution depends on the dynamics of the operating context as the task progresses.

    - 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 purposefully maintaining a direction of travel towards a target destination or sequence of destinations over variable 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 purposefully and transition between water and air or water and land including mixed surfaces attaining a target destination, or sequence of destinations over extended distances beyond the current state of the art.

    - 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:

    - 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.

Multidisciplinary research activities should address all of the following:

- Proposals should involve appropriate expertise in the necessary relevant disciplines to reach their objectives. SSH is particularly relevant in addressing human aspects related to 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 well-defined 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-CL4-2024-DIGITAL-EMERGING-01-04: Industrial leadership in AI, Data and Robotics boosting competitiveness and the green transition (AI Data and Robotics Partnership)
(IA)[[https://www.europarl.europa.eu/RegData/etudes/STUD/2021/662906/IPOL_STU(2021)662906_EN.pdf]]

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 60.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio coverage, grants will be awarded to applications not only in order of ranking but at least also to the two highest ranked proposals for each of the two expected outcomes (1. The creation of systems to address large scale challenges using combined robotics data and AI solutions, 2. The creation of systems to address large scale resource optimisation challenges using combined AI and Data solutions). Proposals should clearly identify the outcome it will focus on.
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. 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. 40% budget for FSTP in sub-area 'creation of systems to address large scale resource optimisation challenges using combined AI and Data solutions'

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 avoidance and 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 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.

Proposals should clearly identify the outcome it will focus on.

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 focus will be on the integration of tools, systems sub-systems and solution in the pilot by the grant beneficiaries. In this case, proposals are not expected to involve the use of financial support to third parties.

- 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.

Financial Support to Third Parties: Projects should use FSTP to leverage novel technical advantage to address the operation of the pilot and to thereby support end users and service providers in addressing the challenges of the green deal. Third parties are expected to use the pilots for developing, testing and validating innovative solutions with significant impact on the green deal. Proposals should clearly delineate the expected contributions from the main beneficiaries as well as from the third parties, to ensure their coherence and impact. 40% of the EU funding requested by the proposal should be allocated to the purpose of financial support to third parties.

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 should include a clear business case and exploitation strategy.

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 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.

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

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-DIGITAL-EMERGING-01-22: Fundamentals of Software Engineering (RIA)

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 13.50 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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 exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [265].

Expected Outcome: Responsible software engineering methods, tools, and best practices leveraging, among others, novel AI and data technologies to accelerate the development and maintenance of software, including for multi-architecture systems, addressing in particular efficient and agile modelling, verification and validation, as well as vulnerability assessment and mitigation.

Scope: Proposals are expected to progress state of the art in at least one of these areas:

- Methods, mechanisms and tools that allow smart intelligent system specification, agile system and code development, advanced code analysis, fault prediction and location and

[265] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

self-repair by using emerging techniques, in particular based on AI and data technologies. This may include environments that allow to automatically derive requirements and produce conceptual and architectural models. Tools should support mastering complex requirements, design-by-contract programming at all levels of integration, semi-automatic creation of pre-conditions, post-conditions and invariants for software modules facilitating automated unit and integration testing.

- Methods and tools for the development of dynamic and resilient software for systems running on multiple processing architectures including cross-compilation, run-time self-adaptation and multi-architecture executables.

Projects are expected to demonstrate their developments in at least three industrial or societal use-cases. Implementing responsible software engineering, the use-cases should address functional as well as non-functional requirements and principles like optimising energy usage, reducing the environmental footprint, security-by-design, and data protection.

Projects should provide a dissemination and use strategy. Research and Development should interface with relevant existing standards, where appropriate. Projects are encouraged to deliver results under Open Source licenses.

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.

European Innovation Leadership in Photonics

Proposals are invited against the following topic(s):

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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 18.00 million.
Type of Action	Research and Innovation Actions
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.

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

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

Scope: Proposals should address at least one of the following activity areas:

- Light-based solutions to let the communication network sense, while transporting data, for example

o To enhance the security and resilience of the network

o To make network resources more energy efficient

o To warn and protect against natural disasters, earthquakes etc.

o To monitor the infrastructure where the fibre is deployed (traffic, stress in bridges…)

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

o Fiber to the home, fiber to the antenna or fiber to the sky (satellite), for example with coherent passive optical networks, free space optics, Lifi or optical beamforming and steering

o 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 (Photonics Partnership) (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 15.00 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 15.00 million.
Type of Action	Innovation Actions
Technology Readiness Level	Activities are expected to start at TRL 2-5 and achieve TRL 4-7 by the end of the project – see General Annex B.

Expected Outcome: 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 TRL 2-7, 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.

It should 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. Care will be taken that it will not compete with existing commercial offers.

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 which offers a broad range of photonics technologies that cover the entire photonics innovation spectrum from concept to commercialization (TRL2-7).

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 should 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.

Users and early adopters may start individual support cases at different levels of technology readiness depending on their needs: TRL 2 may be useful for researchers using photonic technologies whereas industrial users may start higher, e.g. at TRL 4 or 5. Support cases

should increase the start TRL by at least two levels. All actions taken together should cover TRL work between 2 and 7.

The action should build on relevant previous European initiatives and existing infrastructure at European and regional levels, use an appropriate 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 should also be capable of demonstrating a strong business plan towards durable funding and sustainability of its activities.

This topic implements the co-programmed European Partnership Photonics.

Call - Digital and emerging technologies for competitiveness and fit for the Green Deal

HORIZON-CL4-2024-DIGITAL-EMERGING-01-CNECT

Conditions for the Call

Indicative budget(s)[266]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[267]	Indicative number of projects expected to be funded
		2024		
Opening: 15 Nov 2023				

[266] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[267] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Deadline(s): 19 Mar 2024				
HORIZON-CL4-2024-DIGITAL-EMERGING-01-21	RIA	20.00	4.00 to 6.00	4
HORIZON-CL4-2024-DIGITAL-EMERGING-01-23	CSA	2.00	Around 2.00	1
HORIZON-CL4-2024-DIGITAL-EMERGING-01-31	RIA	33.00	Around 33.00	1
HORIZON-CL4-2024-DIGITAL-EMERGING-01-34	CSA	3.00	Around 3.00	1
HORIZON-CL4-2024-DIGITAL-EMERGING-01-42	RIA	15.00	Around 15.00	1
HORIZON-CL4-2024-DIGITAL-EMERGING-01-45	IA	15.00	4.00 to 5.00	3
Overall indicative budget		88.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

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

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-DIGITAL-EMERGING-01-21: Open Source for Cloud/Edge to support European Digital Autonomy (RIA)

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 20.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

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

- 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).
- Standards and best practices consolidating the European Open Computing Architecture, as well as its interfaces to current industry standards.

Scope: Proposals should 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. Such modules include basic input/output systems, pre-boot execution environments, power-on authentication, etc., supporting heterogeneous processor architectures, and

- 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).

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

Proposals should include a clear business case and exploitation strategy.

Proposals 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. They 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 and make use of previous developments under Horizon Europe.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-23: Public recognition scheme for Open Source (CSA)

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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the

	Research and Training Programme of the European Atomic Energy Community (2021-2025). [268].

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

- Establishment of a system of European annual awards that acts as a spotlight stirring up contributions to Open Source Software and Hardware projects.
- 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

Graphene and 2D materials: Europe in the lead

Proposals are invited against the following topic(s):

[268] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

HORIZON-CL4-2024-DIGITAL-EMERGING-01-31: Pilot line(s) for 2D materials-based devices (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 33.00 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 33.00 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.

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 two-Dimensional 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 shall continue the efforts started in the 2D experimental Pilot Line of the Graphene Flagship and build on the IP developed therein, to 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 should focus on the (co-)integration of 2DM with established technologies such as CMOS[269] integration and heterogeneous integration.

Proposal should include supply of standard semiconductor technologies such as CMOS, ASICs[270], 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. Proposals should consider the following TRLs: for Electronics applications starting TRL 3 with ending TRL 5 and for photonics applications starting TRL 3-4 and ending TRL 5-6.

Multidisciplinary research and innovation activities should address all of the following:

269 Complementary metal–oxide–semiconductor (CMOS)
270 Application-specific integrated circuit (ASIC)

- 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. In particular projects are expected to develop synergies and relate to activities and outcomes of the projects selected under the other topics of 'Graphene and 2D materials: Europe in the lead' and where relevant of the KDT JU.

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3.00 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 3.00 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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [271].

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

- Well-coordinated European, national and regional initiatives in the field of graphene and two-dimensional 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[272].
- 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.

[271] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

[272] https://www.flagera.eu

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

Proposals are invited against the following topic(s):

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 15.00 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 15.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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 and Mercosur 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 security[273].
Technology Readiness Level	Activities are expected to start at TRL 1-4 and achieve TRL up to 6 by the end of the project – see General Annex B.
Procedure	The procedure is described in General Annex F. The following exceptions apply: If funding for projects funded under topic is coming from more than one EU programme, this action is an EU Synergy grant[274] and the following conditions will apply: In all cases, this is provided that no double funding occurs, the cumulative financing does not exceed the total eligible costs of the action, and the support from the different Union programmes is calculated on a pro-rata basis in accordance with the documents setting out the conditions for support (Art. 15.4 of the Horizon Europe Regulation and Art. 63.9 of the Regulation on Common Provisions of the Structural Funds).
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 700.000 in order to allow third parties to achieve closer coordination and greater

273 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.

274 Calls could be EU Synergies calls, meaning that projects that have been awarded a grant under the call could have the possibility to also receive funding under other EU programmes, including relevant shared management funds. In this context, applicants should consider and actively seek synergies with, and where appropriate possibilities for further funding from, other R&I-relevant EU, national or regional programmes (such as ERDF, ESF+, JTF, EMFF, EAFRD, Innovation Fund and InvestEU), where appropriate, as well as private funds or financial instruments.

	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. 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. A minimum 85% of the EU funding requested by the proposal should be allocated to the purpose of financial support to third parties, selected through joint calls with the participating national funding agencies. Third parties will be funded through projects of around EUR 2.5 million per project. The EU will contribute with up to 33% of the national contribution to the projects.

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 gaps 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 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.

HORIZON-CL4-2024-DIGITAL-EMERGING-01-45: Quantum sensing and metrology for market uptake (IA)

Specific conditions	
Expected EU	The Commission estimates that an EU contribution of between EUR 4.00

contribution per project	and 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 15.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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 and the following additional associated country: Israel[275]. 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 [276]

[275] Legal entities established in Israel are eligible to participate in this action on the basis that (i) Israel is an associated country (and continues to be on the date of the opening of this topic for submission); and (ii) Israel meets specific conditions. Prior to the adoption of this Work Programme, questionnaires were sent to non-EEA associated countries and countries in the process of association in order to assess their eligibility to participate.

[276] 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.

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.

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, Radio Frequency sensing and processing, imaging and recognition, radars energy, electronics industry, construction, mining, prospection, aerospace, materials, automotive, energy transformation 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) where necessary, to achieve the projects objectives, activities could also address more fundamental research issues; (iv) 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.

Destination 5: Open Strategic Autonomy in Developing, Deploying and Using Global Space-Based Infrastructures, Services, Applications and Data

Today EU citizens enjoy watching satellite TV, increasingly accurate global navigation services for all transport modes and users (e.g. mobile phones and car navigation systems), extended Earth monitoring for land, marine, atmosphere and climate change, global meteorological observation and accurate cartographies of a wide number of variables. Space also makes important contributions to security crisis management and emergency services. These are key assets for the EU policies on climate, environment, transport, agriculture and secure society (e.g. Maritime Strategy, the Arctic Strategy, the Digital Agenda, the Common Security and Defence Policy, the Sustainable Development Strategy, the SGDGs). Finally, the space sector is a source of economic growth, jobs and exports.

This destination will directly support the following Key Strategic Orientations, as outlined in the Strategic Plan:

- KSO A, '**Promoting an open strategic autonomy by leading the development of key digital, enabling and emerging technologies, sectors and value chains** to accelerate and steer the digital and green transitions through human-centred technologies and innovations.'

- KSO B, '**Restoring Europe's ecosystems and biodiversity, and managing sustainably natural resources** to ensure food security and a clean and healthy environment.'

- KSO C, '**Making Europe the first digitally led circular, climate-neutral and sustainable economy** through the transformation of its mobility, energy, construction and production systems.'

- KSO D, '**Creating a more resilient, inclusive and democratic European society,** prepared and responsive to threats and disasters, addressing inequalities and providing high-quality health care, and empowering all citizens to act in the green and digital transitions.'

Proposals for topics under this Destination should set out a credible pathway to contributing to the following expected impact:

Open strategic autonomy in developing, deploying and using global space-based infrastructures, services applications and data, including by reinforcing European independent capacity to access space, securing the autonomy of supply for critical technologies and equipment, and fostering the EU's space sector competitiveness.

This expected impact is fully in line with the Space Strategy for Europe and the EU Space Programme Regulation. Horizon Europe R&I funds will contribute to this expected impact along two main axes by:

- Providing support with R&I funding to the EU space sector at large;
- Making a specific impact with the EU action with R&I to prepare the future evolutions of the EU Space Programme components, including providing R&I support in preparation of the Quantum initiative as well as support in preparation of the Secure Connectivity initiative proposed by the Commission.

This Destination is therefore structured along the following headings:

1. Foster competitiveness of space systems

2. Reinforce EU capacity to access to space

3. Evolution of services: Copernicus

4. Development of applications for Galileo, EGNOS and Copernicus and PRS and GOVSATCOM user activities

5. Innovative space capabilities: Quantum

6. Targeted and strategic actions supporting the EU space sector

In addition, Other Actions related to this Destination cover:

- The management and coordination of the European Space Partnership;
- The evolution of space and ground infrastructures for Galileo/EGNOS;
- The development of SSA-SST and GOVSATCOM capabilities, including actions preparing for the Secure Connectivity initiative proposed by the Commission in February 2022;
- Specific activities related to Space entrepreneurship ecosystems (incl. New Space and start-ups);
- In-Orbit Demonstration and In-Orbit Validation.

While headings 1, 2 and 6 will support the EU space sector at large and are largely based on the recommendation of the Strategic Research and Innovation Agenda, headings 3, 4 and 5 and the Other Actions will be supporting the EU Space Programme components as well as the emerging Secure Connectivity and Quantum initiatives.

All headings will contribute to the 'Open strategic autonomy in developing, deploying and using global space-based infrastructures, services applications and data'.

Heading 1 - Foster competitiveness of space systems

The European space sector and space economy need to improve space-based capabilities, capture new markets (e.g. on-orbit servicing), adapt to rapidly changing markets whilst staying competitive in the satellite communication, navigation and Earth observation sectors.

This requires the development of new competitive technologies for space and ground systems, such as very high throughput and flexible satellites, very high-resolution sensors, on-board and ground Artificial Intelligence (AI), optical communication and quantum technologies, as well as advanced robotics and flexible payload and platform concepts. We need to prepare the ground for future modular, flexible and intelligent satellites. In the mid to long term, the future space ecosystem should include hybrid, smart and reconfigurable satellites, which can be manufactured, assembled and serviced directly in-orbit, and with a de-orbiting capacity.

Digitalisation and automation will enable advanced design and manufacturing methods (including additive manufacturing) and "Digital Twins", plug-and-play modularity, as well as model-based system engineering. This will yield reductions in mass, cost, emission, energy consumption and development time.

Disruptive technologies and concepts should be further developed to bring breakthrough innovation to the space sector, while at the same time advancing technology maturation in the view of qualification on ground or via In-Orbit Demonstration and Validation activities.

Heading 2 - Reinforce EU capacity to access space

Two specific challenges stand out. Firstly, the increasingly competitive global market for launch services, , secondly, the emerging opportunities in space transportation that have not been yet seized by European launch actors characterised by new uses of space (e.g. small satellites, larger constellations, payload recovery, payload quick deployment), new services (e.g. direct orbit injection, in-orbit servicing) and in-space transportation. This will require, amongst others, new concepts for reducing the production and operation cost such as reusability (including stage recovery and landing) of launcher and vehicle components, and low cost, high thrust and green propulsion, modular avionics, autonomous systems, micro launchers, re-entry vehicles and modern and flexible test and launch facilities. This will require urgent activities to enable operational capacities by the latest 2030.

Disruptive technologies, methodologies and concepts should be developed to bring breakthrough innovation to the launcher systems sector as well as to contribute to cost reduction and contribute to the preparation of a competitive European Space Transportation beyond 2030.

Heading 3 - Evolution of services: Copernicus

Copernicus core services (Climate Change, Marine Environment Monitoring, Land Monitoring, Atmosphere Monitoring, Emergency Management and Security) must evolve and improve to better respond to new and emerging policy needs, such as anthropogenic CO2, greenhouse gas and pollutant monitoring, climate change mitigation and adaptation, EU arctic policy, coastal area and integrated management, sustainable development goals, environmental compliance, protection of natural resources, ecosystems and biodiversity monitoring, food security, agriculture, fisheries, aquaculture, crisis management, safe transport, sustainable and clean energy, border management, preserving cultural heritage, as

well as other new domains that could bring key contributions to the European Green Deal and to other EU priorities and policies.

Heading 4 - Development of applications for Galileo, EGNOS and Copernicus and PRS and GOVSATCOM user activities

European Global Navigation Satellite System (EGNSS), encompassing the Galileo and EGNOS components of the EU Space Programme, and Copernicus capacities are unique and world-class and should be fully utilised for EU citizens, companies and society. Research and innovation should therefore foster the development of EGNSS downstream applications and promote their adoption in the EU and worldwide, in particular in markets with a long lead-time (e.g. maritime, rail, aviation), and in areas where Galileo offers unique differentiators (high accuracy, authentication, Search and Rescue, PRS).

Copernicus based applications and services can serve, for example, polar research, monitoring of the environment, maritime and coastal monitoring, natural disasters, civil security, migration and agriculture. They can bring, with EGNSS, a key contribution to the European Green Deal and to the sustainable management of natural resources. The public sector should be motivated to support space-based services via innovation procurement. Synergies between Galileo/EGNOS and Copernicus, as well as synergies with non-space programmes, leveraging the combination of space data with non-space data, will open new avenues for the creation of a wealth of new and innovative applications and services. The use of Copernicus and Galileo/EGNOS for the European Science Cloud (EOSC) and Destination Earth initiatives should equally be taken into account and promoted.

GOVSATCOM activities are needed for developing the user base, supporting the development of demonstration terminals and the validation of the services, identifying the tools needed for the future GOVSATCOM HUB services and supporting the development of applications.

Heading 5 - Innovative space capabilities: Quantum

Quantum Technologies, as an emerging field with great potential to be applied in the EU Space programme, require basic research and validation activities for its application to space.

Space will pave the way for quantum technologies in EU space infrastructure and for space-based services (e.g. quantum inter-satellite communication, next generation atomic clocks or quantum sensors). It is of the highest strategic importance for the EU and its industry to be competitive and to become a global leader in this area. It will provide enhanced services to EU citizens and allow overcoming limitations and challenges of the current generation of quantum technologies. Therefore, R&I shall foster the development and use of EU sourced space qualified quantum components, including mission design, integration and in-orbit demonstration and validating. The availability of adequate ground segment infrastructure for testing and validating the quantum space mission needs to be ensured too. Synergies with GOVSATCOM will be considered.

Heading 6 - Targeted and strategic actions supporting the EU space sector

Development of associated technologies and actions of key importance to the other headings and sections will be pursued. These actions will at the same time contribute to foster the competitiveness of the EU space sector, to reinforce our capacity to use and access space and to perform R&I for the EU Space Programme.

These targeted and strategic actions will include the development of critical technologies for EU non-dependence and space science activities.

Evolution of space and ground infrastructures for Galileo/EGNOS (Other Actions)

For Galileo/EGNOS, the international context, the competitive environment with emerging actors and novel techniques in the value chain, the increasing threats, and the evolution of the technologies, components and systems, including dual-use technology, call for a constant adaptation of the EU space infrastructure to these changing realities.

To meet these challenges, EU needs sustained investments in R&D for innovative mission concepts, technology and systems. These will ensure the continuity of the EGNSS service, minimise the risks for technology inclusion in the infrastructure, thanks to anticipated development and testing including in-orbit, protect better this infrastructure against modern threats (notably cyber, jamming/spoofing, natural hazards), and increase the open strategic autonomy in key technologies. Overall, they will maintain the EU´s leadership position in the Global Navigation Satellite Systems.

Development of innovative capabilities SSA-SST and GOVSATCOM (Other Actions)

Space Situational Awareness (SSA) and GOVSATCOM innovative components will be developed in the EU Space Programme fostered by Horizon Europe R&I.

Space Situational Awareness (SSA) will provide services to European users including spacecraft owners/operators and governmental entities that will reinforce the protection and resilience of European space and ground infrastructures against various hazards and risks (mainly collisions in/from space, Near Earth Objects or space weather events). New challenges are posed by the ever-increasing orbital population of smaller satellites and space debris and the associated increased risk of orbital collisions, fragmentations and re-entries. R&I activities shall address these challenges by developing novel architectures and technical solutions for ground/space sensors, data processing, networking and operation centres (including critical technological elements for the realisation of crucial future space weather applications and services) to ensure safety and sustainability of space operations in Europe as well as by improving current EUSST (European Space Surveillance and Tracking) services and implementing new ones (space debris mitigation and remediation services; space weather services).

The **GOVSATCOM** component aims to provide reliable, secured and cost-effective satellite communications services to EU and Member State authorities with an infrastructure supporting secure critical missions and the ability to exchange sensitive information in an environment of worldwide hybrid threats (including the Arctic). Research and innovation activities will foster the development of European satcom security related technologies and

increase European independence from foreign critical technologies and exploiting synergies with defence /security assets.

The Secure Connectivity initiative aims to develop a secure and autonomous space-based connectivity system for the provision of guaranteed and resilient satellite communications. Among the objectives are to develop, build and operate a multi=orbital space-based state-of-the-art connectivity system, continuously adapted to governmental satellite communications demand evolution, and to complement the Union pool of satellite communication capacities and services and integrate the GOVSATCOM ground segment infrastructure, as well as to integrate the European quantum communication space infrastructure (EuroQCI) to enable secure transmission of cryptographic keys. In this context, this Work Programme already prepares the ground for the Secure Connectivity initiative via two Actions under Other Actions related to Secure Connectivity infrastructure on the one hand and upstream R&D activities on the other hand and via a Quantum topic focused on QKD cryptography.

Space entrepreneurship ecosystems (incl. New Space and start-ups) (Other Actions)

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 EU Space Programme will be established.

Limiting participation in certain actions to Member States (and certain candidate associated countries to Horizon Europe)

The Space research part of the Horizon Europe Programme is by default open to the world, promoting international cooperation to drive scientific excellence.

However, an important aspect of this Destination consists in ensuring security and strengthening open strategic autonomy across key technologies and value chains, taking advantage of the possibilities that space offers for the security of the Union and its Member States. This objective requires special rules in specific cases to set the requisite eligibility and participation conditions to ensure the protection of the integrity, security and resilience of the Union and its Member States. Hence, on an exceptional basis and duly justified, this work programme may foresee a limited participation to entities from selected countries. Such exceptional circumstances would relate to prevalent considerations to safeguard the Union's strategic assets, interests, autonomy or security. Possibilities for such limitations are framed by Article 22(5). Out of 25 call topics, 13 remain fully open while 12 are proposed for limited participation. Other activities in other actions might also be proposed for limited participation.

Innovation Actions – Legal entities established in China are not eligible to participate in Innovation Actions in any capacity. Please refer to the Annex B of the General Annexes of this Work Programme for further details.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL4-2023-SPACE-01	137.50		28 Mar 2023
HORIZON-CL4-2024-SPACE-01		46.30	20 Feb 2024
Overall indicative budget	137.50	46.30	

Call - STRATEGIC AUTONOMY IN DEVELOPING, DEPLOYING AND USING GLOBAL SPACE-BASED INFRASTRUCTURES, SERVICES, APPLICATIONS AND DATA 2023

HORIZON-CL4-2023-SPACE-01

Conditions for the Call

Indicative budget(s)[277]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[278]	Indicative number of projects expected to be funded
		2023		
Opening: 22 Dec 2022 Deadline(s): 28 Mar 2023				
HORIZON-CL4-2023-SPACE-01-11	IA	10.10 [279]	1.00 to 2.50	5
HORIZON-CL4-2023-SPACE-01-12	RIA	15.00 [280]	0.50 to 2.50	7
HORIZON-CL4-2023-SPACE-01-13	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-SPACE-01-21	RIA	20.00 [281]	Around 20.00	1
HORIZON-CL4-2023-SPACE-01-22	RIA	23.10 [282]	4.00 to 10.00	4
HORIZON-CL4-2023-SPACE-01-23	RIA	10.00 [283]	2.00 to 5.00	3
HORIZON-CL4-2023-SPACE-01-31	RIA	8.60 [284]	2.00 to 3.00	3

277 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

278 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

279 Of which EUR 5.00 million from the 'NGEU' Fund Source.

280 Of which EUR 7.50 million from the 'NGEU' Fund Source.

281 Of which EUR 8.00 million from the 'NGEU' Fund Source.

282 Of which EUR 9.00 million from the 'NGEU' Fund Source.

283 Of which EUR 4.00 million from the 'NGEU' Fund Source.

284 Of which EUR 4.00 million from the 'NGEU' Fund Source.

HORIZON-CL4-2023-SPACE-01-32	RIA	3.00 [285]	Around 3.00	1
HORIZON-CL4-2023-SPACE-01-33	RIA	2.00 [286]	Around 2.00	1
HORIZON-CL4-2023-SPACE-01-34	RIA	5.00 [287]	Around 5.00	1
HORIZON-CL4-2023-SPACE-01-62	RIA	5.00 [288]	2.00 to 2.50	2
HORIZON-CL4-2023-SPACE-01-63	RIA	3.00 [289]	1.00 to 1.50	2
HORIZON-CL4-2023-SPACE-01-71	RIA	10.70	1.00 to 1.50	8
HORIZON-CL4-2023-SPACE-01-72	RIA	20.00 [290]	2.00 to 3.00	7
Overall indicative budget		137.50		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Foster competitiveness of space systems

Proposals are invited against the following topic(s):

285 Of which EUR 1.00 million from the 'NGEU' Fund Source.
286 Of which EUR 1.00 million from the 'NGEU' Fund Source.
287 Of which EUR 2.50 million from the 'NGEU' Fund Source.
288 Of which EUR 2.00 million from the 'NGEU' Fund Source.
289 Of which EUR 1.00 million from the 'NGEU' Fund Source.
290 Of which EUR 10.00 million from the 'NGEU' Fund Source.

HORIZON-CL4-2023-SPACE-01-11: End-to-end Earth observation systems and associated services

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.00 and 2.50 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 10.10 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering all the areas described in the scope section, 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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [291].

[291] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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 enhancing flexibility and reducing costs while maintaining or increasing the performance (e.g. autonomous, reconfigurable, high-capacity systems) and support debris mitigation by system design. The agility to face uncertainties, 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 6/7) for high performance Earth observation;
- Contribute to European non-dependence for the development of Earth-observation technologies;
- Contribute to the European Green Deal.

This topic will contribute to develop and deploy global space-based services, applications and data, and therefore contributes to foster the European 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 and sustainable approaches.

2) R&I on Satellite Data Management and Processing including image processing for end-to-end performance improvement (also with regards to power consumption, e.g. using AI, simplification of data management, data fusion, advanced processing units, mass memory) and on infrastructures and networks for 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 in industrial processes 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.

A proposal should address only one of the three areas outlined above, which must be clearly identified. A proposal may operate in different topics/domains/sectors e.g. in the development of pilot and testing applications.

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, it is expected that projects make use of existing European technologies and/or building blocks at component level contributing to European non-dependence and strengthen competitiveness. Furthermore, proposed activities should be complementary to national activities and activities funded by the European Space Agency (ESA).

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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 0.50 and 2.50 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 15.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve the following TRLs by the end of the project: Activities addressing area 1: TRL 4-6 Activities addressing area 2: TRL 3-5 – The reference TRL definition is the ISO 16290:2013 applicable to the

	space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering all the areas described in the scope section, 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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [292].

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 economically 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 (in-space servicing, satellite telecommunications, EO, robotics for exploration and In-Situ Resource Utilisation etc.). The list of enabling technologies includes but is not limited to:

- Electric Propulsion
- Robotics incl. hardware, software, control
- Automation incl. hardware, software, processes
- Artificial Intelligence
- Software factory, automatic code generation

[292] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

All technologies can be used/researched especially in combination with standardisation, modularisation and digitalisation.

This topic aims at enabling efficient in-space services (e.g. maintenance, assembly, manufacture, logistics, warehousing and disassembly/reuse/recycling) by focussing on target-oriented development and qualification of innovative, game-changing technologies, key technology building blocks as well as 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, cost-efficient missions by using synergies with terrestrial sectors;
- A sustainable, highly automated, flexible and economically 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 to enable in-orbit demonstration/validation (IOD/V);
- Short to medium term disruptive development and maturation of key technologies (up to TRL 7);
- Contribute to European 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 European 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, 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 or other space infrastructure elements, enhancing flexibility, allowing mass-customization, and fostering the 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.

A proposal should address only one area, which must be clearly identified.

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[293] and Electric Propulsion[294].

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

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.

[293] www.h2020-peraspera.eu
[294] www.epic-src.eu

Indicative budget	The total indicative budget for the topic is EUR 2.00 million.
Type of Action	Coordination and Support Actions
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [295].

Expected Outcome: This support activity aims at enabling a sustainable, highly automated, flexible and economically viable space infrastructure in a holistic approach, prepared to maximise commercial opportunities in space and on earth: the future space ecosystem. A paradigm shift from conventional concepts towards more adaptive and intelligent solutions, which are strongly required to explore new business opportunities for European actors in space.

This requires a targeted evolution of the Future Space Ecosystem (FSE) roadmap that identifies and describes pathways to innovative and promising applications and services in the fields of in-space services. It shall consider new space approaches, enabling technologies (e.g. electric propulsion, automation & robotics, AI, high-performance and reliable avionics) and synergies with terrestrial sectors, strengthened by continuous market and trend analyses.

Not only enabling technology is required to foster future business in space, but also a suitable, sustainable framework, providing enough flexibility to let businesses emerge and grow in the field of On-Orbit Services (OOS).

Therefore, the project is expected to contribute to the following outcomes:

- Future Space Ecosystem roadmap focussing on 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;
- Coherent principles, guidelines and standards for On-Orbit Services (e.g. life-extension, maintenance, assembly, logistics, etc.) supporting European actors implementing their

[295] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

business in this domain ensuring consideration of sustainability, safety and competitiveness.

Scope: To ensure the safe and economically viable use of space and space-based assets in the long term, technologies need to be identified, a roadmap established and acceptable rules, standards and methodologies defined. Therefore, this coordination and 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 and taking into account new space approaches, enabling technologies (e.g. electric propulsion, robotics, AI, high-performance and reliable avionics), synergies with terrestrial sectors while making use of continuous market and trend analyses;
- Identify and select the most promising technologies (game-changer/key technologies) and create a pathway for quick maturation and space qualification;
- Closely follow 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 and to verify the applicability of the existing principles and guidelines for future missions;
- Contribute to the international dialogue on recommendations for guidelines and standards for In-Space Services based on the work done in the European Operations Framework (EOF)[296] in H2020 supporting the European Commission in policy and standards development and fostering interoperability of EU space systems to access the rising global OOS market.
- Carry out targeted dissemination and outreach activities for FSE activities to showcase the paradigm shift and to facilitate support of European stakeholders with regards to OOS and to promote EU Space R&I activities in the future space ecosystem.

The above-mentioned activities should take into account modularisation, standardisation, digitalisation and new industrial processes and production tools to the fullest extent possible to maximise the business opportunities.

Active participation of industrial actors including SMEs in the consortium is expected.

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

Reinforce EU capacity to access to space

Proposals are invited against the following topic(s):

[296] www.h2020-peraspera.eu/EOF

HORIZON-CL4-2023-SPACE-01-21: Low cost high thrust propulsion for European strategic space launchers - technologies maturation including ground system tests

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 20.00 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 20.00 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	The conditions are described in General Annex B. The following exceptions apply: 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). 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, Iceland and the United Kingdom. The eligibility of entities established in the United Kingdom to participate is conditional upon the following: (i) the United Kingdom is associated to Horizon Europe, and (ii) the United Kingdom's equivalent space calls are published and open to the EU entities on a reciprocal basis." Both conditions must be fulfilled on the date of the opening of this topic for submission. 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 restrains 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 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.
Technology Readiness Level	Activities are expected to achieve TRL 7 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.

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 Europe‘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

- Cost reduction investigation and demonstration.

These outcomes will contribute to enhance Europe's open 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 ground 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 Europe's 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,
- throttlability,
- HMS - Health Monitoring Systems,
- 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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 4.00 and 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 23.10 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	The conditions are described in General Annex B. The following exceptions apply: 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). 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, Iceland and the United Kingdom. The eligibility of entities established in the United Kingdom to participate is conditional upon the following: (i) the United Kingdom is associated to Horizon Europe, and (ii) the United Kingdom's equivalent space calls are published and open to the EU entities on a reciprocal basis." Both conditions must be fulfilled on the date of the opening of this topic for submission. 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 restrains 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 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.
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.

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, focusing 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 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 [297] 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 maneuvre, aerodynamics and aerothermal design, attitude control system, actuators and propulsion system, advanced GNC design, propellant management/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

[297] This excludes full launcher development

consideration of manufacturing, 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 refueling 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 (Guidance, Navigation and Control).

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-01-23: Modern, flexible and efficient European test, production and launch facilities

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.00 and 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 10.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply:

	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). 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, Iceland and the United Kingdom. The eligibility of entities established in the United Kingdom to participate is conditional upon the following: (i) the United Kingdom is associated to Horizon Europe, and (ii) the United Kingdom's equivalent space calls are published and open to the EU entities on a reciprocal basis." Both conditions must be fulfilled on the date of the opening of this topic for submission. 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 restrains 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 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.
Technology Readiness Level	Activities are expected to achieve TRL 5-7 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.

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 Europe‘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 Europe, ground assets portability to speed-up deployments.

These outcomes will contribute to enhance Europe's 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 launchers essential for the implementation of EU space programme. It could benefit from the current transformational wave in industry, 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, access to space ground facilities in Europe need to become interoperable allowing to decrease the launch service costs.

In coherence with 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. security and safety

The maturation will go up to an incremental demonstration 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 standards 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 demonstration 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.

Evolution of services: Copernicus

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-SPACE-01-31: Copernicus for Atmosphere and Climate Change, including CO2

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.00 and 3.00 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 8.60 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering all the areas described in the scope section, 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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for

	Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [298].

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 service element for the monitoring of anthropogenic CO2 emissions
- Development of efficient and reliable new product chains, calling for innovation 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 improve the service in a modern and user-friendly way while preserving continuity of what has been achieved.
- 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 extremely hazardous events as well as 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 extreme compound, sequences and/or cascading events to climate variability and change.

Scope: The areas of R&I are:

- 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 networks with profiling capabilities (e.g. lidars, ceilometers, radars). In addition, new methods to advance substantially in the modelling of secondary aerosols and their interlinks with gas phase primary aerosols, as well as with gas and aqueous. With an integrated modelling approach, the integration of new observational data

[298] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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, desert dust storms, storm surges, heatwaves. The proposed research and development should be modular and scalable and the transfer of research results to 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 the numerical requirements (accuracy, mass-conservation) for the numerical schemes in the CO2MVS system for 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. 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.

A proposal should address only one area, which must be clearly identified.

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 and should support the automatization of different processes orchestration. The activities of the project should raise synergies towards Earth Observation Envelope Programme (ESA EOEP) and 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 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.

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-01-32: Copernicus for Emergency Management

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3.00 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 3.00 million.
Type of Action	Research and Innovation Actions

Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). The Joint Research Centre (JRC) may participate as member of the consortium selected for funding.
Technology Readiness Level	Activities are expected to achieve TRL 6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [299].

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, population density, vulnerability) 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 early warning and active global fire detection and fire monitoring (delineation, grading, damage assessment, plume dispersion) from geosynchronous and Geostationary sensors, including refined post-processing for active-fire detection confidence and false alarm removals,

[299] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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 and/or in-situ data linking where relevant to the European and Global Flood Awareness Systems (EFAS & GloFAS),

- improvements of the hydrologic process representation in the continental and/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 hydrometeo events as droughts and associated multi-sectoral impacts,

- optimised integration of different data sources (e.g. reanalysis + observations from rain gauges + remote sensing) and different indexes characterising extreme meteorological events and related hazards, 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 methods tracking severe to extreme events and associated hazards as the hydrometeo one and droughts.

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 and multi-platform, multi sensor AI techniques for automatic recognition of severe to extreme events and production of early warning indicators;

- 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 and ground-based observations and measurements, meteorological data from ground weather stations and radar, data from aerial platforms, social media or crowdsourcing, 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 and should support the automatization of different processes orchestration. 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 and further details on the topic in the Guidance document.

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-01-33: Copernicus in-situ component

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	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.
Legal and	The rules are described in General Annex G. The following exceptions

financial set-up of the Grant Agreements	apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [300].

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 access and wider 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 and ground-based data critical for the production, calibration 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, methodologically sound and sustainable 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 CO_2;
4. Application of machine learning technologies for the quality control of historic and real-time meteorological and hydrological in-situ observations;

[300] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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 interoperable, modular and scalable, should support the automatization of different processes orchestration, 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 collection, processing, quality control, and automation including the use of Artificial Intelligence and machine learning to ensure robust and non-biased high added value datasets.

In the selection of the topical scope of new-approaches to in-situ data and ground-based data collection, policy data needs should be considered, e.g. data needed for Green Deal monitoring, such as landscape features or parameters providing information on carbon farming.

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. This includes also cost estimates ensuring sustained operations. 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 and further details on the topic in the Guidance document.

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-01-34: Copernicus for Marine Environment Monitoring

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 5.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [301].

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 innovation 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.

[301] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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 and Copernicus Participating States coastal services using digital innovation and facilities (including using Copernicus DIAS if appropriate). This requires:

- The development of improved pan-European 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 observations and modelling systems and downstream coastal observation and 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, Green Deal).

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 Marine service. The proposed research and development should be modular and scalable and should support the automatization of different processes orchestration. 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.

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

Development of applications for Galileo, EGNOS and Copernicus, PRS and GOVSATCOM

For a description of call topics related to Development of applications for Galileo, EGNOS and Copernicus, as well as to PRS and GOVSATCOM applications, please refer to "Indirectly managed actions by EUSPA" on the section "Other Actions" of this work programme.

Innovative space capabilities: SSA, GOVSATCOM, Quantum

For a description of call topics related to SSA, please refer to the “Identified beneficiaries” part in the section “Other Actions” of this work programme. For a description of call topics related to GOVSATCOM, please refer to "Indirectly managed actions by ESA" in the section "Other Actions" of this work programme.

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-SPACE-01-62: Quantum Communication Technologies for space systems

Specific conditions	
Expected EU contribution per	The Commission estimates that an EU contribution of between EUR 2.00 and 2.50 million would allow these outcomes to be addressed

project	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	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). 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, Iceland and the United Kingdom. The eligibility of entities established in the United Kingdom to participate is conditional upon the following: (i) the United Kingdom is associated to Horizon Europe, and (ii) the United Kingdom's equivalent space calls are published and open to the EU entities on a reciprocal basis." Both conditions must be fulfilled on the date of the opening of this topic for submission. 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 restrains 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 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.
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [302].
Security Sensitive Topics	Some activities resulting from this topic 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.

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 Quantum Key Distribution (QKD).

[302] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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.

Proposals must address all the above-mentioned, expected outcomes.

Two proposals will be selected under this call.

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. (e.g. ETSI, European Telecommunications Standards Institute) or propose and implement the creation of new standardisation activities through the creation of additional working groups.

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-01-63: Quantum Space Gravimetry Phase-A Study

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.00 and 1.50 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 3.00 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 75 pages.
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply:

	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). 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, Iceland and the United Kingdom. The eligibility of entities established in the United Kingdom to participate is conditional upon the following: (i) the United Kingdom is associated to Horizon Europe, and (ii) the United Kingdom's equivalent space calls are published and open to the EU entities on a reciprocal basis." Both conditions must be fulfilled on the date of the opening of this topic for submission. 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 restrains 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 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.
Technology Readiness Level	Activities are expected to achieve TRL 3 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [303].

Expected Outcome:

- Support the EU space policy and the EU 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.

Up to 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

[303] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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 European Commission's and ESA's experts. Each study will conclude with a Preliminary Requirement Review.

Quantum Space Gravimetry Pathfinder Mission Statement:

The goals of the quantum space gravimetry (QSG) pathfinder mission are:

a. to consolidate the leadership of the European Union know-how in Quantum Sensing for Space and

b. to demonstrate key technologies, their viability and related performances.

Necessary for the later deployment of a full QSG mission (e.g. (e.g. Bose-Einstein condensates (BEC) technology, rotation compensation, etc.), and pave the way to future space-based applications and services enabled by its data.

The focus of the QSG pathfinder mission shall be on the operation of a complete quantum accelerometer system and the detailed characterization of its performance in space. The results of the pathfinder mission, demonstrating the European Union capabilities and validating the technology, shall enable the development of ultra-sensitive sensors for an ambitious post-pathfinder QSG mission in the next step.

The QSG pathfinder mission shall be launched within this decade, paving the way for the deployment of an EU QSG mission within the next decade. The technology developed shall foster the EU non-dependence and leadership in this domain.

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

Targeted and strategic actions supporting the EU space sector

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-SPACE-01-71: Scientific exploitation of space data

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.00 and 1.50 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 10.70 million.
Type of Action	Research and Innovation Actions

Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities are expected to achieve TRL 3-4 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.

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 Copernicus DIAS (Data and Information Access Services), 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 Space

Science 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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.00 and 3.00 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 20.00 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 75 pages.
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). In order to achieve the expected outcomes, and safeguard the Union's strategic assets, interests, autonomy, or security, and more particularly, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, and in order to guarantee the protection of the strategic interests of the Union and its Member States, participation is limited to legal entities established in Member States, Norway and Iceland. 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 restrains 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 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.
Technology Readiness Level	Activities are expected to achieve TRL 5-8 by the end of the project. However, the target TRL may be different from technology line to technology line – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering all the areas described in the scope section, 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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the

	Research and Training Programme of the European Atomic Energy Community (2021-2025). [304]. 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 non-EU jurisdictions. Applicants must acknowledge and incorporate this obligation in the proposal and Annex I to the Grant Agreement.

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 and enhancing competitiveness by developing products/technical capabilities reaching equivalent or superior performance level than critical technologies and capabilities from outside EU;
- 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 if relevant 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).

Technology areas:

- High speed DAC-ADC based on European Technology [Target TRL 6-7]
- Space qualified carbon fibre pre-impregnated material sources for launcher and satellite subsystems [Target TRL 8-9]
- Enhanced performance and space qualified detectors – IR range [Target TRL 7-8]

[304] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- Mid-power range electric propulsion thruster technology:
    - Qualification of electrical propulsion thrusters and PPUs for power ranges up to 5kW [Target TRL 7-8]
- Mid-power range electric propulsion thruster technology:
    - Development of new generation of thrusters based on non-dependent propellants (i.e. not Xe or Kr) [Target TRL 4-5]
- Replacement solutions for metallic lead (Pb) [Target TRL 7]
- High performance, cost effective multi - junction solar cells for space applications [Target TRL 5]

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 published on the Funding & Tenders Portal outlining all relevant information to the selected actions.

A proposal should address only one technology area, which must be clearly identified.

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 in the proposal 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 and describe in the proposal a suitable technology development process aiming at avoiding export restrictions of non-EU states and assess vulnerabilities of the supply chain.
- In the proposal, define specific tasks as part of the work plan, with the objective of:
    1. analyse and describe in detail the supply chain, each entity and its role in the supply chain, and if relevant identify critical dependencies from outside EU;
    2. develop the technical roadmap and business plan for commercialization, space mission insertion, including time to market indication, of the developed product.

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.

Evolution of Galileo and EGNOS services and infrastructure

For a description of call topics related to Evolution of Galileo and EGNOS services and infrastructure, please refer to "Indirectly managed actions by ESA" in the section "Other Actions" of this work programme.

Space entrepreneurship ecosystems (incl. New Space and start-ups) and skills - CASSINI

For a description of call topics related to Space entrepreneurship ecosystems, please refer to "Indirectly managed actions by EUSPA" in the section "Other Actions" of this work programme.

Call - STRATEGIC AUTONOMY IN DEVELOPING, DEPLOYING AND USING GLOBAL SPACE-BASED INFRASTRUCTURES, SERVICES, APPLICATIONS AND DATA 2024

HORIZON-CL4-2024-SPACE-01

Conditions for the Call

Indicative budget(s)[305]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[306]	Indicative number of projects expected to be funded
		2024		
Opening: 21 Nov 2023 Deadline(s): 20 Feb 2024				

[305] The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

[306] Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

HORIZON-CL4-2024-SPACE-01-35	RIA	4.00	1.50 to 2.00	2
HORIZON-CL4-2024-SPACE-01-36	RIA	8.00	Around 4.00	2
HORIZON-CL4-2024-SPACE-01-64	RIA	14.20	Around 14.00	1
HORIZON-CL4-2024-SPACE-01-73	RIA	20.10	2.00 to 3.00	7
Overall indicative budget		46.30		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Reinforce EU capacity to access to space

Evolution of services: Copernicus

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-SPACE-01-35: Copernicus for Land and Water

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.50 and 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 4.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: The Joint Research Centre (JRC) may participate as member of the consortium selected for funding. 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).
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering all the areas described in the scope section, 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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [307].

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 Deal policy and/or user requirements, including those related to the EU mission: "Climate neutral and smart cities", and to technological developments.

[307] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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 Monitoring 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, in particular the existing continental and global scale hydrological monitoring and forecasting systems of the Copernicus Emergency Management and Climate Change services (CEMS & C3S), 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). The development should consider cross services approaches and all relevant Copernicus service products, in particular the existing continental and global scale hydrological monitoring and forecasting systems of the Copernicus Emergency Management and Climate Change services (CEMS & C3S).

- 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 areas 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 value 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 and observations (e.g.; SWOT mission) 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.

A proposal should address only one area, which must be clearly identified.

The projects should take into account the existing services and clearly define to what extent the services will be improved with new elements or products, including the use of enhanced models, algorithms, tools and techniques to generate new product(s). The projects should build, where possible and relevant, on open-source models, tools and datasets already used or produced by the existing Copernicus services.

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 and should support the automatization of different processes orchestration. 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.

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-01-36: Copernicus for Security

Specific conditions	
Expected EU	The Commission estimates that an EU contribution of around EUR 4.00

contribution per project	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 8.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). In order to achieve the expected outcomes, and safeguard the Union's strategic assets, interests, autonomy, or security, and and more particularly, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, and in order to guarantee the protection of the strategic interests of the Union and its Member States, participation is limited to legal entities established in Member States, Norway and Iceland. 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 approved by the 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 restrains 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.
Technology Readiness Level	Activities are expected to achieve TRL 5-6 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [308].
Security Sensitive Topics	Some activities resulting from this topic 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.

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.

[308] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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.

- Integration of the Geospatial Artificial Intelligence (GeoAI) and Earth Observation data analytics with a variety of other application-specific data sources like data from remote sensors accessed through IOT, as well as crow-sourced data, high velocity transnational data and social media posts.

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. Copernicus has to potential to become a major contributor to European Data spaces that play an important role for security solutions. 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.

Additional information will be provided in the ***Strategic Research Agenda for Copernicus Security Services*** (SRA-CSS V1.0, to be released end 2022).

Actions aimed at service evolution will have to 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 with regard to heir 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 and further details on the topic in the Guidance document.

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

Development of applications for Galileo, EGNOS and Copernicus, PRS and GOVSATCOM

For a description of call topics related to Development of applications for Galileo, EGNOS and Copernicus, as well as to PRS and GOVSATCOM applications, please refer to "Indirectly managed actions by EUSPA" on the section "Other Actions" of this work programme.

Innovative space capabilities: SSA, GOVSATCOM, Quantum

For a description of call topics related to SSA, please refer to the “Identified beneficiaries” part in the section “Other Actions” of this work programme. For a description of call topics related to GOVSATCOM, please refer to "Indirectly managed actions by ESA" in the section "Other Actions" of this work programme.

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-SPACE-01-64: Quantum Space Gravimetry Phase-B study & Technology Maturation

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 14.00 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 14.20 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 90 pages.
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). 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, Iceland and the United Kingdom. The eligibility of entities established in the United Kingdom to participate is conditional upon the following: (i) the United Kingdom is associated to Horizon Europe, and (ii) the United Kingdom's equivalent space calls are published and open to the EU entities on a reciprocal basis." Both conditions must be fulfilled on the date of the opening of this topic for submission. 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 restrains 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.
Technology Readiness Level	Activities are expected to achieve TRL 6-7 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: The granting authority can fund a maximum of one project.

Expected Outcome:

- Support the EU space policy and the EU Green Deal by providing the detailed definition of a quantum space gravimetry (QSG) 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.

Quantum Space Gravimetry Pathfinder Mission Statement:

The goals of the quantum space gravimetry (QSG) pathfinder mission are:

a. to consolidate the leadership of the European Union know-how in Quantum Sensing for Space and

b. to demonstrate key technologies, their viability and related performances.

Necessary for the later deployment of a full QSG mission (e.g. BEC technology, rotation compensation, etc.), and pave the way to future space-based applications and services enabled by its data.

The focus of the QSG pathfinder mission shall be on the operation of a complete quantum accelerometer system and the detailed characterization of its performance in space. The results of the pathfinder mission, demonstrating the European Union capabilities and validating the technology, shall enable the development of ultra-sensitive sensors for an ambitious post-pathfinder QSG mission in the next step.

The QSG pathfinder mission shall be launched within this decade, paving the way for the deployment of an EU QSG mission within the next decade. The technology developed shall foster the EU non-dependence and leadership in this domain.

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

Targeted and strategic actions supporting the EU space sector

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-SPACE-01-73: Space technologies for European non-dependence and competitiveness

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.00 and 3.00 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 20.10 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 75 pages.
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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). In order to achieve the expected outcomes, and safeguard the Union's strategic assets, interests, autonomy, or security, and and more particularly, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, and in order to guarantee the protection of the strategic interests of the Union and its Member States, participation is limited to legal entities established in Member States, Norway and Iceland. 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 approved by the 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 restrains 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.
Technology Readiness Level	Activities are expected to achieve TRL 5-8 by the end of the project. However, the target TRL may be different from technology line to technology line – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering all the areas described in the scope section, 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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [309]. Beneficiaries will be subject to the additional exploitation obligations:

[309] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

	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.

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).

The technology areas are:

- Low shock Non-Explosive Actuators (NEA) for smallsats [Target TRL 7]
- High data rate (12.5 to 28 Gbps or higher 56 Gbps), low consumption, short range links [Target TRL 7]
- Power laser sources in the eye-safe region [Target TRL 6]
- Enhanced performance and space qualified detectors – visible range [Target TRL 7-8]
- Ultra Deep Submicron technology for next generation space integrated circuits: ASICS, FPGA and microprocessors [Target TRL 5]
- Discrete power devices (200V normally-off GaN) [Target TRL 7]

- Photonics components [Target TRL 7]

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 published on the Funding & Tenders Portal outlining all relevant information to the selected actions.

A proposal should address only one technology area, which must be clearly identified.

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 in the proposal the technologies and/or technology processes to be used and demonstrate 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 and describe in the proposal a suitable technology development process aiming at avoiding export restrictions of non-EU states and assess vulnerabilities of the supply chain.

- In the proposal, define specific tasks as part of the work plan, with the objective of:

    1. analyse and describe in detail the supply chain, each entity and its role in the supply chain, and if relevant identify critical dependencies from outside EU;

    2. Develop the technical roadmap and a business plan for commercialization, space mission insertion, including time to market indication, of the developed product.

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.

Evolution of Galileo and EGNOS services and infrastructure

For a description of call topics related to Evolution of Galileo and EGNOS services and infrastructure, please refer to "Indirectly managed actions by ESA" on the section "Other Actions" of this work programme.

Destination 6: A human-centred and ethical development of digital and industrial technologies

This destination will directly support the following Key Strategic Orientations (KSOs), as outlined in the Strategic Plan:

- **KSO D, Creating a more resilient, inclusive and democratic European society,** prepared and responsive to threats and disasters, addressing inequalities and providing high-quality health care, and empowering all citizens to act in the green and digital transitions

Proposals for topics under this Destination should set out a credible pathway contributing to the following expected impact:

- **A human-centred and ethical development of digital and industrial technologies**, through a two-way engagement in the development of technologies, empowering end-users and workers, and supporting social innovation.

The priorities in this domain are aligned with the objectives of the Digital Decade to build secure and sustainable digital infrastructures and to support the digital transformation of businesses and public services. It will directly support individual innovators (researchers, developers, high-tech SMEs and start-ups, etc.) engaged in developing the technologies for a trustworthy and human-centric digital environment, building on a more resilient, and decentralised internet architecture and enabling new social and business models respecting European values.

In particular, the Digital Decade and its compass set a target 80% of citizens using a digital ID solution by 2030. In order to achieve this target, Europe needs to build an Internet of Trust empowering end-users with more control over their data and their digital identity. The Internet of Trust will also mobilise innovators towards more sustainable and secure internet infrastructures, supporting the Digital Decade objective of setting up 10000 climate neutral highly secured edge nodes. Finally the R&I priorities in this domain will fully support the international dimension of the digital decade by promoting the EU human-centred approach with key international partners.

As Europe takes the lead in the green and digital transitions, workers, regions, and societies are faced with extremely fast transformations, and will be differently affected by these changes, creating opportunities for inclusive technological and social development, but also carrying the risk of increased inequalities. The rapid adoption of new technologies offers an immense potential for improved standards of living, safer mobility, better healthcare, new jobs, or the personalisation of public services. At the same time, it presents risks such as skills mismatches, digital divides, customer lock-in, or serious breaches of security or privacy.

As Europe sets off on its path to recovery towards a greener, digital and more resilient economy and society, the need to improve and adapt skills, knowledge and competences

becomes all the more important. All communities have the right to benefit from these new digital and green developments, leading to a more inclusive society, increased trust and a better adoption of new products and services. Developments in digital and enabling technologies have the potential to enhance social inclusion, can inform up-skilling training programmes and ensure a two-way engagement with society with regard to developing technologies.

The issue of trust has become central in the use of technologies, following revelations about the exploitation of personal data, large-scale cybersecurity and data breaches, and growing awareness of online disinformation. As outlined in the White Paper on Artificial Intelligence (COM(2020)65), for AI technologies, trust requires in particular improving transparency (explainability, expected levels of performance). For the Internet, increasing trust requires new tools and services to ensure that GDPR is a reality for end-users.

It is also an opportunity for Europe to re-gain presence on the consumer electronics market, by developing new interactive applications in various sectors with solutions meeting European values and requirements in terms of privacy and security. The COVID-19 crisis has also shown how important distance and innovative learning is for society.

Actions under this Destination will support EU objectives of inclusiveness, by supporting a human-centred approach to technology development that is aligned with European social and ethical values, as well as sustainability. These actions will further contribute to addressing the challenges faced by European industry and support the creation of sustainable, high-quality jobs by targeting skills mismatches, the need to empower all workers, and ethical considerations relating to technological progress.

Actions should devote particular attention to openness of the solutions and results, and transparency of the research process. To ensure trustworthiness, public awareness and support, wide adoption by user communities for the benefit of society, actions should promote the highest standards of transparency and openness. Actions should ensure that the processes and outcomes of research and innovation align with the needs, values and expectations of society, in line with Responsible Research and Innovation.

This Destination is structured into the following headings, which group topics together with similar outcomes to address a common challenge:

- Leadership in AI based on trust

The objective of this heading is to ensure autonomy for Europe in AI, leading the way in research, development and deployment of world-class technologies that are beneficial to humans individually, organisationally and societally, and that adheres to European values, such as the principles reflected in our fundamental rights and environmental sustainability. Technologies need to be developed that industries and citizens will trust, so and that they could be applied in a wide range of applications and industrial sectors. Trustworthy AI is particularly key in applications such as (but not limited to) healthcare or in diverse critical infrastructures such as energy and transportation.

Some topics of this heading are under the co-programmed Partnership 'AI, Data and Robotics'.

Proposals are encouraged to link with relevant European Institute of Innovation and Technology (EIT) and its Knowledge and Innovation Communities (KICs), in particular the EIT Digital.

EIT Digital plays role in shaping technologies and innovations that work for people. At least two of its focus areas, Digital Wellbeing and Digital Cities, address directly topics such as ethical artificial intelligence, predictive analytics or augmented and virtual reality that are relevant to this areas. The solutions will benefit from the increasing will of citizens to participate in the sharing economy. EIT Digital, through projects with cities for example, improves engagement and inclusiveness of the citizens and of the visitors by increasingly organising and exposing data, especially in real time and along with analytics and machine learning. Augmented and virtual reality of the cities are another facet of exposing or simulating city data from the past, present or future to the benefit of citizens.

- An Internet of Trust

The issue of trust in the internet has become central, following revelations about the exploitation of personal data, large-scale cybersecurity and data breaches, and growing awareness of online disinformation. A 2019 survey[310] shows that half of the global internet users are more concerned about their online privacy compared to a year previously. Distrust in the Internet is causing people to change the way they behave online, for example by disclosing less personal information. Users also express an increasing level of distrust of social media platforms.

The objective of this heading is to develop a trustworthy digital environment, built on a more resilient, sustainable, and decentralised internet, to empower end-users with more control over their data and their digital identity, and to enable new social and business models respecting European values.

- eXtended Reality (XR)

Due to its low presence in the consumer electronics industry, Europe is increasingly dependent on external providers in this area. This raises concerns about its digital sovereignty in crucial domains such as digital interaction services that are being adopted by a growing number of European users and industries. The COVID-19 crisis has shown how important distance and innovative learning is for society, our children, their parents and their teachers, maintaining social and educational links under challenging circumstances. Emerging technologies such as virtual reality, eXtended Reality or immersive environments provide numerous opportunities for personalised, innovative, efficient and inclusive learning, for learners of all ages, gender and condition

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The objective of this heading is to gain industrial leadership in eXtended Reality technologies and immersive environments, while ensuring the European values of privacy, ethics and inclusiveness. It also aims to support the digital transformation of education through these technologies in particular.

- Systemic approaches to make the most of the technologies within society and industry.

This heading promotes various systemic approaches to encourage creativity and make the most of the technologies developed elsewhere within society and industry. They include testing ideas in local communities; support for IP, standardisation and industry-academia exchanges; art-driven design; and assessments of complex socio-economic systems. These are complemented by support for a network of National Contact Points (NCPs), with a special emphasis on engaging with new actors.

Activities beyond R&I investments will be needed to realise the expected impacts: testing, experimentation, demonstration, and support for take-up using the capacities, infrastructures, and European Digital Innovation Hubs made available under the Digital Europe Programme; further development of skills and competencies via the European Institute of Innovation and Technology, in particular EIT Digital and EIT Manufacturing; upscaling of trainings via the European Social Fund +; use of financial instruments under the InvestEU Fund for further commercialisation of R&I outcomes; and links to the thematic smart specialisation platform on industrial modernisation.

- Digital Humanism and human compatible technologies

The Digital Decade policy programme ("The Path to the Digital Decade"), sets a European approach for its digital transformation based on values and technological leadership.

In parallel, there is still a lack of systematic approaches to ensure a constructive role of culture in technology development in the spirit of methods to integrate non-technology innovation and social innovation.

Efforts will be pursued to help ensuring people are at the centre of the digital transformation, in line with our values and principles.

- European standards for industrial competitiveness

The Communication 'Updating the 2020 Industrial strategy: towards a stronger Single Market for Europe's recovery' made clear that global leadership in technologies goes hand-in-hand with leadership in standard-setting and ensuring interoperability across the EU industrial ecosystems. EU industry needs European and international standards that underpin its twin digital and green transition. A minimal set of standards will also enable the creation of a soft layer for data sharing and exchange amongst EU industrial ecosystems and underpinning data spaces. Establishing global leadership in key priority standards such as cyber-security is also a critical matter for the competitiveness and resilience of EU industries. Global convergence on the same international standards helps reduce adaptation costs and strengthens EU and global

value chains. Thus the topic of standards is an essential cross-cutting issue when it comes to the twin transition of the industrial ecosystems and making European industry more resilient.

Several digital decade targets for 2030 are addressed like tech up-take facilitated by interoperability standards, climate neutral highly secure edge notes and ethical principles for human-centred algorithms through international endorsed standards.

Standardisation can be an important factor for valorising EU R&I projects, allowing new technologies to enter into a more mature phase, favouring their applicability on a larger scale and hence promoting their uptake.

Bringing the research and innovation community early on into the standards-making process is key to identify the issues and priorities, share views on future developments and stakeholder needs, and to provide recommendations to the European Commission and European standardisation organisations for future standardisation needs. Putting standards into science is very important to anticipate and prepare the standards-development process in future areas.

- International cooperation

The proposed international coordination 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 Japan, the Republic of Korea, and Singapore as part of our digital partnerships with countries in the Indo-Pacific region. The resulting project will foster links with relevant research institutions on R&I activities in the field of digital. It will also support the newly announced Trade and Technology Council with India.

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. Cooperation between Africa and EU will expand on the existing outcomes of Africa-EU cooperation especially in the field of Innovation Hubs cooperation[311], sustainability of African digital ecosystems, reinforcement of the African private sector and contribution to Africa's economic growth (including SDG attainment). It will also contribute to the overarching objectives of our continental partnership in full alignment with the principles of the Global Gateway.

Cooperation with Latin America will aim at exploiting the potential of the newly established BELLA network and implement the outcomes of EU-LAC dialogues in the context of digitalisation and R&I.

[311] See in particular ICT 58 Call : https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/ict-58-2020

Additionally, international collaboration is encouraged or targeted in several thematic areas may also be addressed within the respective Joint Undertakings (Smart Networks and Services, EuroHPC, and Key Digital Technologies).

Expected impact

Proposals for topics under this Destination should set out a credible pathway to contributing to a **human-centred and ethical development of digital and industrial technologies**, and more specifically to one or several of the following impacts:

- Increased inclusiveness, by supporting a human-centred approach to technology development that is aligned with European social and ethical values (including gender and intersectional aspects), as well as sustainability;
- Sustainable, high-quality jobs by targeting skills mismatches, the need to empower workers, including those at risk of social exclusion, and ethical considerations relating to technological progress[312].

Innovation Actions — Legal entities established in China are not eligible to participate in Innovation Actions in any capacity. Please refer to the Annex B of the General Annexes of this Work Programme for further details.

The following call(s) in this work programme contribute to this destination:

Call	Budgets (EUR million)		Deadline(s)
	2023	2024	
HORIZON-CL4-2023-HUMAN-01	55.00		29 Mar 2023
HORIZON-CL4-2023-HUMAN-01-CNECT	201.50		29 Mar 2023
HORIZON-CL4-2024-HUMAN-01		61.00	19 Mar 2024
Overall indicative budget	256.50	61.00	

312 2019 CIGI-Ipsos Global Survey on Internet Security and Trust

Call - A human-centred and ethical development of digital and industrial technologies

HORIZON-CL4-2023-HUMAN-01

Conditions for the Call

Indicative budget(s)[313]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[314]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 29 Mar 2023				
HORIZON-CL4-2023-HUMAN-01-31	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-HUMAN-01-32	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-HUMAN-01-33	CSA	5.00	Around 1.00	5
HORIZON-CL4-2023-HUMAN-01-51	RIA	10.00	Around 10.00	1
HORIZON-CL4-2023-HUMAN-01-52	RIA	4.00	Around 4.00	1
HORIZON-CL4-2023-HUMAN-01-53	RIA	10.00	1.50 to 2.50	4
HORIZON-CL4-2023-HUMAN-01-54	CSA	2.50	Around 0.50	5
HORIZON-CL4-2023-HUMAN-01-62	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-HUMAN-01-63	CSA	3.00	2.50 to 3.00	1
HORIZON-CL4-2023-HUMAN-01-64	CSA	8.00	0.50 to 1.00	8
HORIZON-CL4-2023-HUMAN-01-91	CSA	2.50 [315]	Around 2.50	1

313 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

314 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

315 Of which EUR 1.00 million from the 'NGEU' Fund Source.

HORIZON-CL4-2023-HUMAN-01-92	CSA	2.00 [316]	Around 2.00	1
HORIZON-CL4-2023-HUMAN-01-93	CSA	2.00 [317]	Around 2.00	1
Overall indicative budget		55.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Systemic approaches for accelerating uptake of technology and innovation

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-31: Toolbox for efficient IP licensing for market uptake and societal value creation (CSA)

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.

316 Of which EUR 0.80 million from the 'NGEU' Fund Source.
317 Of which EUR 0.80 million from the 'NGEU' Fund Source.

Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [318].

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.

[318] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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[319], 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)

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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the

[319] A9-0284/2021

	Research and Training Programme of the European Atomic Energy Community (2021-2025). [320].

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

- Strengthen the base for industry-academia collaboration in the higher education institutions in the European Union and Associated Countries 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 the European Union and Associated Countries and spread novel approaches for industry-academia-public sector co-creation in cross-border manner;
- Boost valorisation of excellent research results and innovation, i.e. transforming them into sustainable solutions with economic and social value.

Scope: There is a clear need to improve industry-academia interactions in Europe[321] and enhance knowledge valorisation[322] 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.[323]

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 should integrate appropriate Social Sciences and Humanities (SSH) disciplines, with appropriate experts and/or partners, in order to produce outcomes enhancing its societal impact. Particular attention should be paid to promoting gender-responsive and inclusive research and innovation outputs.

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320 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

321 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.

322 Council Recommendation (EU) 2021/2122 of 26 November 2021 on a Pact for Research and Innovation in Europe (ST/13701/2021/INIT)

323 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

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, Erasmus+ Alliances for Innovation, European Skills Agenda and relevant national and regional activities.

HORIZON-CL4-2023-HUMAN-01-33: Fostering knowledge valorisation through societal and cultural interactions (CSA)

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.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [324].

Expected Outcome: 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;

[324] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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 diverse communities, develop skills 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 participants 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, or if they increase existing inequalities. 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, social and humanities scientists, 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.

Research and Innovation for Industry 5.0

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-51: Pilots for an innovative human-centric industry (RIA)

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 10.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

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 and learning 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 [325] 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 project will develop and demonstrate the concept of human-centricity in a real-life, operational industrial environment in at least ten pilots. A pilot may consist of an individual company, but may also span multiple companies that interact across (possibly transnational) value chains or in a local innovation ecosystem. The set of pilots, as a whole, will cover a variety of industrial sectors and company sizes, including SMEs and start-ups and/or scale-ups, and will be situated in at least 13 different EU Member States or countries associated to the Horizon Europe programme.

The pilots will innovate and go beyond-the-state-of-the-art with respect to the purposeful application of advanced technologies, which would typically be situated at a Technology Readiness Level (TRL) of 6 or 7. With regard to digital solutions, the aspect of cyber-security must be adequately addressed in design, implementation and governance. Purposeful application signifies that innovation is expected that promotes a human-centric industry and may imply, as appropriate, innovation 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 and future workforce,
- 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,
- how technological, process and organisational innovation can offer jobs that remain rewarding for the individual worker along the life cycle,

[325] 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

- the development of and experimentation with the use of advanced technologies (such as robotics) in learning environments to increase the skill level of the current and future workforce,

- the response to the COVID-19 pandemic in terms of the organisation of work and its effects.

The project 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. These include effects and outcomes that pertain to workers' satisfaction and well-being, with a particular interest for the acceptance of and relation with technology. Equally important are the effects and outcomes 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, exploiting the diversity of the pilots and taking into account the specificities of the setting and context of the pilots.

The consortium 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 partnerships and organised civil society (NGOs). A concluding conference will support this goal.

This topic requires an interdisciplinary approach with the effective contribution of SSH disciplines and the involvement of SSH experts and/or institutions.

The proposals should consider the intersectional 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.

Proposers should consider and actively seek synergies with relevant active and finalised projects/activities in Horizon 2020 and Horizon Europe[326] (including public-private and

[326] Including relevant projects resulting from Cluster 2 calls under the Destination "Innovative research on social and economic transformations"(inter alia HORIZON-CL2-2021-TRANSFORMATIONS-01-05, HORIZON-CL2-2022-TRANSFORMATIONS-01-07, HORIZON-CL2-2023-TRANSFORMATIONS-01-01, HORIZON-CL2-2023-TRANSFORMATIONS-01-08, HORIZON-CL2-2024-TRANSFORMATIONS-01-05, HORIZON-CL2-2024-TRANSFORMATIONS-01-09, HORIZON-CL2-2024-TRANSFORMATIONS-01-11) and Cluster 4 calls under the Destination "Climate neutral, circular and digitised production" (inter alia HORIZON-CL4-2021-TWIN-TRANSITION-01-01, HORIZON-CL4-2021-TWIN-TRANSITION-01-07, HORIZON-CL4-2021-TWIN-TRANSITION-01-08, HORIZON-CL4-2022-TWIN-TRANSITION-01-01, HORIZON-CL4-2022-TWIN-TRANSITION-01-06), under the Destination "Increased autonomy in key strategic value chains for resilient industry"(inter alia HORIZON-CL4-2021-RESILIENCE-01-29, HORIZON-CL4-2021-RESILIENCE-01-31), under the Destination "Digital and emerging technologies for competitiveness and fit for the green deal" (inter alia HORIZON-CL4-2021-DIGITAL-EMERGING-01-10, HORIZON-CL4-2022-DIGITAL-EMERGING-01-05, HORIZON-CL4-2023-DIGITAL-EMERGING-01-02) and under the Destination "A human-centred and ethical development of digital and industrial technologies" (inter alia HORIZON-CL4-2021-HUMAN-01-21, HORIZON-CL4-2021-HUMAN-01-25, HORIZON-CL4-2021-HUMAN-01-26, HORIZON-CL4-2022-HUMAN-01-01, HORIZON-CL4-2022-HUMAN-01-14,

public-public partnerships[327] and EIT KICs) and the Digital Europe programme (European Digital Innovation Hubs), as well as within relevant sectorial associations[328]

HORIZON-CL4-2023-HUMAN-01-52: Drivers and success factors for progress towards Industry 5.0 (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 4.00 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 4.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

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[329], 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

HORIZON-CL4-2023-HUMAN-01-02, HORIZON-CL4-2023-HUMAN-01-22, HORIZON-CL4-2023-HUMAN-01-52, HORIZON-CL4-2024-HUMAN-01-53, HORIZON-CL4-2023-HUMAN-01-81)

327 In particular, but not exclusively, the European Partnerships "Made in Europe", "Processes4Planet" and "Artificial Intelligence, Data and Robotics" and "Built4People"

328 such as Manufuture, Cecimo, Orgalim and others.

329 https://ec.europa.eu/info/research-and-innovation/research-area/industrial-research-and-innovation/industry-50_en

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 ten cases. Each case is in a different EU Member State or country associated to the Horizon Europe programme. Cases may be cross-boundary. These cases 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 and type, 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, sustainable business models and resilient value chains, long-term value creation, corporate governance, climate transition and sustainability plans, stakeholder engagement, 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 (global) competitiveness, reputation, attractiveness for talent and for investment, enhanced generation of qualified jobs, adaptive capacity to incremental changes and sudden disruptions (e.g. by reduction of dependencies), progress towards climate change objectives, 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? What are the factors that could diminish or reinforce inequalities through the implementation of advanced technologies in the work place? What is the added value of considering sustainability aspects, including science-based targets, in defining the business strategy?

- **SMEs/start-ups/scale-ups**: How can/do SMEs/start-ups/scale-ups take up Industry 5.0 principles and what is the role of the local innovation ecosystem in this? How does it help these types of enterprises to participate successfully in the green and digital transition of industry?

- **Measurement**: The project will investigate state-of-the-art quantitative and qualitative tools for measuring progress towards Industry 5.0 in its three dimensions of resilience, sustainability and human-centricity and how they can be applied in practice.

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 representativeness 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. A number of workshops involving external experts, including from within the Commission, will support this goals

The project will transfer knowledge in actionable form to relevant actors including policy makers, social partners and industry federations and partnerships, organised civil society (NGOs). A concluding conference will support this goal.

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.

Proposers should consider and actively seek synergies with relevant active and finalised projects/activities in Horizon 2020 and Horizon Europe [330] (including public-private and

[330] Projects that are relevant for industry with respect to the three pillars of the Industry 5.0 concept may result from across the different parts of the HE programme, in addition to HORIZON-CL4-2023-HUMAN-01-51 and HORIZON-CL4-2023-HUMAN-01-53 and the following:
Cluster 2 calls under the Destination "Innovative research on social and economic transformations"(inter alia HORIZON-CL2-2021-TRANSFORMATIONS-01-05, HORIZON-CL2-2022-TRANSFORMATIONS-01-07, HORIZON-CL2-2023-TRANSFORMATIONS-01-01, HORIZON-CL2-2023-TRANSFORMATIONS-01-08, HORIZON-CL2-2024-TRANSFORMATIONS-01-05, HORIZON-CL2-2024-TRANSFORMATIONS-01-09, HORIZON-CL2-2024-TRANSFORMATIONS-01-11)
Cluster 4 calls under the Destination "Climate neutral, circular and digitised production" (inter alia HORIZON-CL4-2021-TWIN-TRANSITION-01-01, HORIZON-CL4-2021-TWIN-TRANSITION-01-07, HORIZON-CL4-2021-TWIN-TRANSITION-01-08, HORIZON-CL4-2022-TWIN-TRANSITION-01-01, HORIZON-CL4-2022-TWIN-TRANSITION-01-06), under the Destination "Increased autonomy in key strategic value chains for resilient industry"(inter alia HORIZON-CL4-2021-RESILIENCE-01-29, HORIZON-CL4-2021-RESILIENCE-01-31), under the Destination "Digital and emerging technologies for competitiveness and fit for the green deal" (inter alia HORIZON-CL4-2021-DIGITAL-EMERGING-01-10, HORIZON-CL4-2022-DIGITAL-EMERGING-01-05, HORIZON-CL4-2023-DIGITAL-EMERGING-01-02) and under the Destination "A human-centred and ethical development of digital and industrial technologies" (inter alia HORIZON-CL4-2021-HUMAN-01-21, HORIZON-CL4-2021-HUMAN-01-25, HORIZON-CL4-2021-HUMAN-01-26, HORIZON-CL4-2022-

public-public partnerships and EIT KICs) and the Digital Europe programme (European Digital Innovation Hubs), as well as within relevant sectorial associations.[331]

HORIZON-CL4-2023-HUMAN-01-53: Localised and Urban Manufacturing, supporting creativity and the New European Bauhaus (RIA using FSTP)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.50 and 2.50 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 10.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio covering demonstration activities in diverse geographical areas of the European Union and Associated Countries, grants will be awarded first to the highest ranked application according to the standard procedure described in Horizon Europe General Annexes D and F, followed by other applications that are the highest ranked among those that ensure the most complementary geographical coverage, provided that the applications attain all thresholds. When assessing geographical coverage, the evaluation will take into account the location of the application's demonstration activities, not the location of the application's participants/beneficiaries.

HUMAN-01-01, HORIZON-CL4-2022-HUMAN-01-14, HORIZON-CL4-2023-HUMAN-01-02, HORIZON-CL4-2023-HUMAN-01-22, HORIZON-CL4-2023-HUMAN-01-52, HORIZON-CL4-2024-HUMAN-01-53, HORIZON-CL4-2023-HUMAN-01-81)

331 such as Manufuture, Cecimo, Orgalim and others.

Expected Outcome: Manufacturing industry, as well as customers, consumers and wider communities, should benefit from the following outcomes, applying the New European Bauhaus concept:[332]

- 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;
- Developing regenerative concepts that offer increased value for the larger community, inspired by the New European Bauhaus, paying particular attention to regenerative design and regenerative and value-added manufacturing;[333]
- Human-centric and participatory approaches to enhance wider engagement and creativity, with appropriate contributions from Social Sciences and Humanities (SSH), including cognitive science;
- Raising the profile of manufacturing as an attractive career option;
- 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.

The New European Bauhaus seeks a transformation relying on industrial ecosystems, from construction to lifestyle and creative industries, from materials to business models, from digital to farming, to provide tailored and affordable solutions. The New European Bauhaus approaches innovation not only in the sense of new technologies but also as a combination of new and traditional techniques, or adaptations of local crafts and knowledge. This topic is intended to integrate the New European Bauhaus initiative into the development and implementation of the decentralised manufacturing vision. New business models and social economy approaches, and Design for Sustainability, can also support the decentralised manufacturing vision.

New technologies offer the possibility of implementing certain 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 and inclusiveness. The focus is on designing and prototyping urban and decentralised processes, not on large-scale adoption by manufacturing industry. However,

332 https://europa.eu/new-european-bauhaus/index_en

333 Horizon Europe and new European Bauhaus NEXUS report, p. 8, 14, https://op.europa.eu/en/publication-detail/-/publication/9f9acd60-8aec-11ec-8c40-01aa75ed71a1/language-en

attention to standards is required, to ensure that the urban and decentralised segments can be integrated in wider manufacturing processes.

Research and Innovation activities should cover:

- Adaptation (and where relevant development) of green and digital technologies that allow production in local and urban contexts with lower environmental impacts, noise, waste, energy and space consumption, and an increased quality of experience.
- Consideration of the potential of circular economy approaches, 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; inclusiveness, possibly including unemployed workforce and marginalised groups; and engaging citizens in the definition of challenges and solutions.
- Artistic experimentation with novel uses of technologies that help push for green solutions in the spirit of S+T+ARTS (starts.eu) and New European Bauhaus, also taking into consideration the different dimensions of inclusion and aesthetics and quality of experience.

Digitally-enabled solutions that support the local and urban manufacturing vision may be considered. 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 Financial Support to Third Parties (FSTP). The maximum amount to be granted to each third party is EUR 100 000, with up to one third of the total EU contribution used for FSTP.

A human-centric approach should be integrated, with appropriate contributions from Social Sciences and Humanities (SSH), and in particular the arts as catalysts of human compatible and green uses of technology (see S+T+ARTS) in transdisciplinary approaches. As part of this, a strategy for skills development should could 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. In particular, projects can consider links to the EU Mission Climate-Neutral and Smart Cities,[334] and to one or more of the 100 EU Cities that will participate.[335]

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334 https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en

335 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_2591

Projects are expected to contribute to the New European Bauhaus initiative by interacting with the New European Bauhaus Community, NEBLab and other relevant actions of the initiative through sharing information, best practice and, where relevant, results.

In the context of this topic, geographical areas of the European Union and Associated Countries are NUTS level 1 regions of European Union Member States and of Associated Countries for which they are defined. In the case of Associated Countries without NUTS classification, the country as a whole is to be considered as one geographical area:

- List of Associated Countries not defined by NUTS level 1: Armenia; Bosnia and Herzegovina; Faroe Islands; Georgia; Kosovo;[336] Israel; Moldova; Tunisia; Ukraine.
- List of countries not defined by NUTS level 1 with which association negotiations are being processed or where association is imminent: Morocco.

HORIZON-CL4-2023-HUMAN-01-54: Green and digital skills and training needs for a just transition (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 0.50 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 2.50 million.
Type of Action	Coordination and Support Actions
Procedure	The procedure is described in General Annex F. The following exceptions apply: *To ensure a balanced portfolio covering skills in the different areas, grants will be awarded to applications not only in order of ranking, but also to projects covering different areas, provided that the applications attain all thresholds.*
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the

[336] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

	Research and Training Programme of the European Atomic Energy Community (2021-2025). [337].

Expected Outcome:

- Reduce skills gaps that hold back the green and digital transitions, by developing and disseminating suitable skills development programmes and training modules, including to prepare future scale-up e.g. through ESF+ or the European Institute of Innovation and Technology (EIT).

- Support collective action on skills development by companies and providers of education and training, and hence support deep-tech innovation; and contribut=e to the European Year of Skills 2023[338], to the large-scale skills partnerships in key industrial ecosystems under the Pact for skills[339], and to the flagship to skill, re-skill and up-skill talents in the deep tech fields outlined in the Commission's new European Innovation Agenda[340].

- Support the training of advanced ICT-specialist skills or other key digital technologies' skills that would contribute to industrial leadership and strategic autonomy and rely on advanced specialised know-how, and to reaching the digital decade targets[341].

Scope: In order to tackle climate and environmental-related challenges, Europe is committed to transform its economy, reducing greenhouse gas emissions by 55% by 2030 and becoming climate neutral by 2050. Delivering on the green transition can have a positive effect on the total number of jobs in the EU with almost 1 million jobs being added with the right policies in place. However, in order for the transition to be successful and fair, existing and new workers need to be equipped with the right skills. In order to do that, they should have access to lifelong learning and dedicated up-skilling and reskilling programmes.

In a similar way, advanced digital skills require more than mastering coding or having a basis of computing sciences. With emerging technologies around quantum, AI, big data and other key technologies, the need for ICT specialist is increasing. For example, there were only 7.8 million ICT specialists in 2019 with a prior annual growth rate of 4.2%. If this trend continues, Europe will be far below the projected need of 20 million experts e.g. for key areas underlying its competiveness and enabling the green transition. More than 70% of businesses report a lack of staff with adequate skills as an obstacle to investments.

337 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

338 State of the Union (europa.eu)

339 Pact for Skills - Employment, Social Affairs & Inclusion - European Commission (europa.eu)

340 New European Innovation Agenda (europa.eu)

341 https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/europes-digital-decade-digital-targets-2030_en

In light of these needs, the Commission has proposed to make 2023 the European Year of Skills.[342] The development and dissemination of innovative training programmes which equip the labour force with green and advanced digital skills has to be part of the solution. Proposals may focus on the skills needs of occupations in one or more specific industrial sectors. They should build on the existing Erasmus+ Blueprint Alliances for sectoral cooperation on skills[343] where available (introduced in the 2016 New Skills Agenda for Europe, and gradually rolled out for an increasing number of sectors), as well as on the existing large-scale skills partnerships in industrial eco-systems under the Pact for Skills [344] following the 2020 European Skills Agenda[345]. Where relevant, outcomes from this call should feed into the Deep Tech Talents Initiative, for instance through cooperation with the European Institute of Innovation and Technology (EIT) in designing a mechanism to monitor and report on deep tech skills that support the green and digital transition, the related education and training programmes and its dissemination in Europe [346].

Skills development should take into account the twin green and digital transition and support labour markets with the aim to increase EU growth potential, including by fostering deep-tech solutions.

Proposals should address at least two of the following aspects:

- Identify, along with relevant stakeholders, specific green or digital skills, defined as those needed to underpin the ongoing and upcoming digital and green transition of the economy to climate neutrality by 2050 and the 2030 digital decade targets, with a particular focus on those that are in shortage; this should take account of the work in the action on skills to support the twin transitions in the European Skills Agenda, in particular the taxonomy of green skills in ESCO[347];

- Devise, test and implement scalable (e.g. through ESF+ or EIT) skills development programmes and trainings to endow the labour force with the identified green or digital skills, with the aim to skill, re-skill and up-skill the workforce as stated in the European Skills Agenda and the new European Innovation Agenda;

- Where possible, such trainings should be designed with a particular focus on the needs of workers that are at risk of becoming redundant due to structural transformations related to the green or digital transition or whose task profiles are expected to change significantly, or currently unemployed people;

- Develop deep tech skills and training programmes in the fields critical for the green and digital transitions, such as circularity, raw and advanced materials, energy-intensive and manufacturing industries, clean-tech, and digital technologies;

342 Commission kick-starts work on the European Year of Skills (europa.eu)
343 https://ec.europa.eu/social/main.jsp?catId=1415&langId=en
344 https://pact-for-skills.ec.europa.eu/index_en
345
346 EIT TO SKILL ONE million tech INNOVATORS – Join the Pledge! | European Institute of Innovation & Technology (EIT) (europa.eu)
347 https://ec.europa.eu/esco/portal/skill

- Support certification and recognition of the green and digital skills and competences, where possible within the relevant accreditation model such as the EIT Label.

Proposals should have a clear strategy for identifying the effectiveness and efficiency of the proposed training. Proposals should also indicate the number of beneficiaries they expect to reach with the project outcomes: both during the initial project duration, and in a possible follow-up project/during scale-up. They should anticipate questions related to the scalability and dissemination of the resulting output, for instance by involving suitable stakeholders.

Where relevant, the proposals should build on and feed into the mechanism developed and applied by EIT[348] such as the Deep Tech Talent Initiative (DTTI), a pioneering programme that aim to skill one million people within European deep tech fields over the next three years. The important dimension of the EIT DTTI is to ensure that companies and industry representatives are part of the curricula development and that curricular elements are continuously updated in line with the changing labour market needs in the technology area.

Proposals should also explain how the activities support transferability, certification and recognition of the skills and competencies, following relevant industry standards or horizontal models, such as EIT Label for non-degree education and training.

Proposals should envisage collaboration and synergies with related projects such as Bridges 5.0.

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This topic requires the effective contribution of Social Sciences and Humanities (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.

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

European standards for industrial competitiveness

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-62: Boosting industrial symbiosis by standardisation (CSA)

Specific conditions	
Expected EU contribution per	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

348 https://www.eitdeeptechtalent.eu

project	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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [349].

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

- Reinforcing the links between standardisation and research and innovation in circular value chains, ensuring that standardisation facilitates cross-sector interoperability at all levels.
- Facilitating the market entry of innovative solutions, which could aid the circularity of resources and zero pollution.
- Identifying the major bottlenecks for standardisation related framework conditions to support industrial symbiosis.
- In order to support the implementation of the ERA Industrial technology roadmap for low carbon technologies[350], helping the development of agile and green 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.

349 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

350 file:///C:/Users/targerg/Downloads/KI0121501ENN.en%20(1).pdf

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 and process industries 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

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 2.50 and 3.00 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 3.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [351].

[351] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link:

Expected Outcome: Projects should support the following outcomes:

- Inclusion of standardisation 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*;
- 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", as well as 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.

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https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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.

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.

In order to achieve the expected outcomes, international cooperation is encouraged.

HORIZON-CL4-2023-HUMAN-01-64: Pre-normative research and standardisation in industrial ecosystems (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 0.50 and 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 8.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [352].

[352] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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;
- Contribute to the implementation of the ERA industrial technology roadmap for low-carbon technologies in energy-intensive industries[353] where relevant;
- 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 [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[354] and leveraging on already adopted practices especially those in the relevant European common data spaces and in the European Research infrastructures.

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353 The roadmap is published at https://op.europa.eu/en/publication-detail/-/publication/c9f70ebf-b48e-11ec-9d96-01aa75ed71a1/

354 Turning FAIR into reality: https://ec.europa.eu/info/sites/default/files/turning_fair_into_reality_1.pdf

Additionally, a strategy for education and skills development within the ecosystems should be developed, associating social partners when relevant.

In order to achieve the expected outcomes, international cooperation is strongly encouraged.

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. In particular, the resulting CSAs should ensure a sensible coverage within their domains and strive towards international cooperation, especially with the international standardisation organisations ISO, IEC and ITU, and similar organisations such as OECD.

International Cooperation

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-91: International Hub for Digital Partnerships in the Indo-Pacific (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 2.50 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 2.50 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

Expected Outcome:

- Support R&I activities and concrete pilot projects (e.g. AI, digital identity) linked to implementing Digital Partnerships with Japan, the Republic of Korea, and Singapore and in the context of the Trade and Technology Council (TTC) with India with a view to drive technology development and standardisation, or regulatory/legislative approaches.
- Support to digital dialogues with international partners, facilitate exchange of views and best practices, regulatory cooperation and where appropriate development of common principles regarding regulation, legislation and standards, developed bilaterally or agreed in international fora.

- 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 that could feed in the discussions of Digital Partnership Councils, which will drive forward the implementation of the Partnerships.
- Foster increased cooperation with appropriate research institutions in Japan, Korea, Singapore on the development, deployment and commercialisation of digital technologies, for example through specific collaboration in the field of R&I.
- Support to trade and industrial policy aspects by promoting European technologies and standards in key international markets.
- Promote and support European positions in international fora such as G7, G20, OECD, WTO, and standardisation organisations.

Scope:

- Organize networks, conferences, workshops and other actions that support R&I activities in the Digital Partnerships with Japan, South Korea and Singapore, and with India in the context of the Trade and Technology Council. The thematic areas of cooperation would include semiconductors, especially next generation of semiconductors, emerging privacy-enhancing technologies, high performing, energy efficient and sustainable 5G and Beyond 5G technologies, data technologies, Artificial Intelligence, SME's digital transformation, smart cities, High Performance Computing and Quantum technologies, standardisation, trust services including eID and blockchain.
- Collect and analyse information as well as conduct surveys and draft reports and position papers on partner countries' R&I policies, strategies and programmes, on all the above-mentioned topics of cooperation including platform cooperation, digital education and digital connectivity.
- Foster cooperation and prepare ground for joint research and raise greater awareness of R&I and industrial cooperation opportunities to promote the digital transformation of industry, disruptive innovation and particularly SMEs.
- The action should ensure that relevant stakeholders from both the EU and the partner countries 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 with a view to addressing current needs, considering future requirements and stimulating long-term cooperation.

HORIZON-CL4-2023-HUMAN-01-92: R&I cooperation with Sub-Saharan Africa (CSA)

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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

Expected Outcome:

- 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, in full compliance with the principles of the Global Gateway.
- Support to trade and industrial policy aspects by promoting European technologies in African markets, and vice-versa.
- Contribute to Africa's economic growth and job creation, and to the Sustainable Development Goals (SDGs), especially through African and R&I.
- Promote EU values for a human-centric digital transformation.
- Support EU's international priorities, as set out in Europe's Digital Decade and Global Gateway.
- Build synergies and prepare an enabling environment for research and investment for the EU.

Scope:

- Foster cooperation and prepare ground for joint research and innovation 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 the 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-01-93: R&I cooperation with Latin America (Mexico, Brazil, Argentina, and other countries in the BELLA network or members of RedClara) (CSA)

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
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

Expected Outcome: The proposal will enable the development of a strategic partnership in R&I with Latin America and the Caribbean including - but not limited to - areas such as Cloud, IoT and 5G. The proposal is expected to contribute to the following outcomes:

- Support implementation of commitments related to R&I resulting from digital dialogues with key countries and sub-regional organisations in LAC (Brazil, Mexico, Argentina, Pacific Alliance, MERCOSUR, EU-LAC Digital Economy Dialogue).
- Develop a roadmap for future R&I cooperation with the LAC region and relevant national, regional and international funding schemes for its application.

- Report on synergies and commonalities in policies, strategies and programmes related to R&I between the EU and partner countries.

- Promote EU values for a human-centric digital transformation and contribute to Sustainable Development Goals (SDGs).

Scope: Joint EU-LAC cooperation on digital transformation has led to the successful completion of the BELLA programme [355], which supported the construction of a new submarine fibre-optic cable linking Lisbon (Portugal) with Fortaleza (Brazil) as well as an onward terrestrial connection with several countries in the region. The new connection provides for the long-term interconnectivity needs of European and Latin American research and innovation communities, but its full potential has not been exploited so far.

The existing digital and ICT dialogues between the EU and Brazil, Mexico and Argentina as well as cooperation with the Pacific Alliance have resulted in agreements to increase cooperation in the area of R&I, and it is expected that the future EU-LAC Digital Dialogue will bring these commitments to a continental perspective, but the agreements made at a political level are still lacking a framework to make this cooperation possible on the ground. Proposals will aim at exploiting the potential of the newly established BELLA network and implement the outcomes of EU-LAC dialogues in relation to digitalisation and R&I.

Proposals are expected to:

- Organize networks, conferences, workshops and other actions that support R&I activities with Brazil, Mexico, Argentina and other countries connected to the BELLA network or members of RedClara[356].

- Promote the exchange of best practices between the European and LAC R&I communities.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 the EU and the partner countries sides are engaged during the process through regional and international workshops and a set of communication and dissemination actions.

Call - A human-centred and ethical development of digital and industrial technologies

HORIZON-CL4-2023-HUMAN-01-CNECT

355 BELLA programme
356 RedClara (LAC region partner in BELLA programme)

Conditions for the Call

Indicative budget(s)[357]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[358]	Indicative number of projects expected to be funded
		2023		
Opening: 08 Dec 2022 Deadline(s): 29 Mar 2023				
HORIZON-CL4-2023-HUMAN-01-01	RIA	35.00 [359]	7.00 to 9.00	5
HORIZON-CL4-2023-HUMAN-01-02	IA	24.00 [360]	Around 8.00	3
HORIZON-CL4-2023-HUMAN-01-03	RIA	20.00 [361]	6.00 to 8.00	3
HORIZON-CL4-2023-HUMAN-01-04	CSA	4.00 [362]	Around 4.00	1
HORIZON-CL4-2023-HUMAN-01-05	IA	10.00 [363]	Around 5.00	2
HORIZON-CL4-2023-HUMAN-01-11	RIA	27.00 [364]	Around 27.00	1
HORIZON-CL4-2023-HUMAN-01-12	IA	14.00 [365]	3.00 to 5.00	5
HORIZON-CL4-2023-HUMAN-01-13	RIA	4.00 [366]	Around 4.00	1
HORIZON-CL4-2023-HUMAN-01-14	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-HUMAN-01-21	RIA	26.00 [367]	5.00 to 8.00	4

357 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

358 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

359 Of which EUR 12.25 million from the 'NGEU' Fund Source.

360 Of which EUR 8.40 million from the 'NGEU' Fund Source.

361 Of which EUR 7.00 million from the 'NGEU' Fund Source.

362 Of which EUR 1.70 million from the 'NGEU' Fund Source.

363 Of which EUR 3.50 million from the 'NGEU' Fund Source.

364 Of which EUR 9.45 million from the 'NGEU' Fund Source.

365 Of which EUR 4.90 million from the 'NGEU' Fund Source.

366 Of which EUR 1.40 million from the 'NGEU' Fund Source.

367 Of which EUR 9.80 million from the 'NGEU' Fund Source.

HORIZON-CL4-2023-HUMAN-01-22	IA	25.00 [368]	5.00 to 8.00	4
HORIZON-CL4-2023-HUMAN-01-23	CSA	2.00	Around 2.00	1
HORIZON-CL4-2023-HUMAN-01-65	CSA	1.50 [369]	Around 1.50	1
HORIZON-CL4-2023-HUMAN-01-66	CSA	2.50 [370]	Around 2.50	1
HORIZON-CL4-2023-HUMAN-01-81	CSA	1.50 [371]	Around 1.50	1
HORIZON-CL4-2023-HUMAN-01-82	CSA	3.00 [372]	Around 3.00	1
Overall indicative budget		201.50		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Leadership in AI based on trust

Proposals are invited against the following topic(s):

368 Of which EUR 8.75 million from the 'NGEU' Fund Source.
369 Of which EUR 0.53 million from the 'NGEU' Fund Source.
370 Of which EUR 1.05 million from the 'NGEU' Fund Source.
371 Of which EUR 0.53 million from the 'NGEU' Fund Source.
372 Of which EUR 1.05 million from the 'NGEU' Fund Source.

HORIZON-CL4-2023-HUMAN-01-01: Efficient trustworthy AI - making the best of data (AI, Data and Robotics Partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 7.00 and 9.00 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 35.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio coverage, grants will be awarded to applications not only in order of ranking but at least also to the highest ranked proposals for each of the two focus areas, provided that the applications attain all thresholds.

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: 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/embedded processors, including small (down to micro/nanoscale) objects with long-term autonomy.

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, while reducing energy consumption.

Proposals should address at least one of the following focus 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.

Proposals should clearly mention which of the two areas will be their main focus area.

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) and gender expertise.

- 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.

- Proposals are expected to dedicate tasks and resources to collaborate with and provide input to the open innovation challenge under HORIZON-CL4-2023-HUMAN-01-04 addressing optimisation. Research teams involved in the proposals are expected to participate in the respective Innovation Challenges.

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).

In order to achieve the expected outcomes, international cooperation is encouraged, in particular with Canada and India.

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)

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 24.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology	Activities are expected to start at TRL 3-5 and achieve TRL 6-7 by

Readiness Level	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: Projects are expected to contribute to the following outcomes:

- Strengthening EU's ecosystem of AI, Data and Robotics excellence and innovation in world class foundational and application-inspired and application-oriented research;
- Technology progress in AI addressing major challenges hampering the deployment of AI, Data and Robotics technologies;
- 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 rights. 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, gender etc. and involve the relevant expertise to address the selected application sector.
- 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.

- Involvement of end-users in the requirement and validation of the pilots to ensure human-centric approach and maximise acceptance.
- Proposals should include a clear business case and exploitation strategy.
- Build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed, notably through the implementation of the FAIR data principles and adopting standardised and discipline-oriented metadata schemas and ontologies.
- 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.

All proposals should demonstrate the assessment criteria upon which the proposed sectors/use-cases have been selected (e.g. in terms of socioeconomic factors, etc.).

All proposals are furthermore 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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6.00 and 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 20.00 million.
Type of Action	Research and Innovation Actions
Eligibility	The conditions are described in General Annex B. The following

conditions	exceptions apply: 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).
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.

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[373] 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, content generation models, etc.

[373] All official EU as well as socially and commercially relevant languages.

- 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.

Multidisciplinary research activities should address at least one of the following:

- Developing novel methods and techniques for producing **context-aware models**, which incorporate factual-based structured and unstructured knowledge in broader situational and temporal information, and continual learning to achieve natural behaviour and reasoning in all intended settings.

- Improving large **pre-trained multilingual language models** to cover a large set of languages[374], 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, computational linguistics, machine learning and natural language processing. Particular attention should be paid to control gender or other biases in language models.

Research should build on existing standards, contribute to standardisation and result in findable, accessible, interoperable and reusable research data including metadata schemas and ontologies.

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.

Proposals are also expected to dedicate tasks and resources to collaborate with and provide input to the open innovation challenge under HORIZON-CL4-2023-HUMAN-01-04

[374] Focus on all official EU as well as socially and commercially relevant languages.

addressing natural language understanding and interaction. Research teams involved in the proposals are expected to participate in the respective Innovation Challenges. This topic implements the co-programmed European Partnership on AI, data and robotics.

HORIZON-CL4-2023-HUMAN-01-04: Open innovation: Addressing Grand challenges in AI (AI Data and Robotics Partnership) (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 4.00 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 4.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Technology Readiness Level	Activities covered under FSTP 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 exceptions apply: Beneficiaries may provide financial support to third parties (FSTP). The support to third parties can only be provided in the form of prizes. 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. FSTP should be eligible to third parties from academia and SMEs in Member States or Associated Countries, but exclude third parties that receive funding under ongoing projects of the following topics[375]: CL4-2023-HUMAN-01-01, CL4-2023-HUMAN-01-03 CL4-2024-HUMAN-01-01, CL4-2024-HUMAN-01-02.

[375] Such teams will participate in the innovation challenges, and can receive rewards, but will not be eligible to receive prize money as they are already funded.

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

- Demonstrate and reinforce Europe's research excellence in AI by driving substantial scientific progress in the following major scientific & technological AI areas: optimisation, explainability, robustness, natural language understanding and interaction, and collaborative intelligence
- Develop prestigious AI open innovation challenges 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 try to tackle and crack major S&T challenges in AI by benchmarking different solutions. The open innovation challenges will be bootstrapped by engaging EU funded projects to participate. Newcomers, rising stars and the wider AI community should be able to join the challenges, giving them the opportunity to benchmark against prestigious teams. The best performing team(s) should be awarded with either with monitory prizes[376], which industry can co-sponsor, and/or non-monetary prizes, e.g. co-authorship of a paper in a prestigious scientific journal, internship in prestigious labs or companies.

Proposals should address the delivery of open innovation challenges with the aim to

- Attract outstanding talent and the best research teams to tackle key scientific and technological AI challenges, of relevance to industry.

[376] Large industry as well as project beneficiaries from CL4-2023-HUMAN-01-01, CL4-2024-HUMAN-01-01, CL4-2024-HUMAN-01-02 and CL4-2024-HUMAN-01-03 will not be eligible for monetary prizes

- Drive substantial and broad scientific progress in key AI areas with the aim to reinforce the research excellence in Europe.

- Prepare at least three open innovation challenges addressing challenges in collaboration with the projects funded under the following topics: CL4-2023-HUMAN-01-01, CL4-2023-HUMAN-01-3, CL4-2024-HUMAN-01-01 and CL4-2024-HUMAN-01-02 focusing on optimisation, explainability, robustness, natural language understanding and interaction, and collaborative intelligence[377] respectively. The projects funded through these calls should participate in the respective open innovation challenges, and can receive rewards, but will not be eligible to receive prize money as they are already funded.

- 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 across Europe

Proposals are expected to

- Provide a sound methodology for the design of AI challenges as open innovation challenges and/or benchmarks, including the definition of challenges to be addressed[378], representative of common needs for a vast adoption in a broad set of industrial and public sectors[379]; as well as the definition of evaluation method and criteria. This involves mobilisation of prestigious scientists and industries (incl. start-ups and SMEs) 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. This task will involve financial support to parties, in line with the conditions set out in part K of the General Annexes..

- Provide a convincing approach to attract the best[380] teams from academia and industry, incl. start-ups and SMEs, students, rising stars and newcomers, to participate in the open innovation challenges and benchmark their different solutions to tackle the AI challenges.

- Address all aspects of running open innovation challenges and best exploit them to maximise the visibility of AI to the wider audience.

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377 This concerns topics CL4-2023-HUMAN-01-01, CL4-2024-HUMAN-01-01, CL4-2024-HUMAN-01-02 and CL4-2024-HUMAN-01-03

378 Proposals should also allow citizens to contribute to the definition of challenges

379 Encouraging and promoting diversity among AI researchers incl. gender and race, socio-cultural background, etc.

380 Encouraging and promoting diversity among AI researchers incl. gender and race, socio-cultural background, etc.

- Mobilise external partners (incl. from industry) in sponsoring and setting up the open innovation challenges and engage sponsors to contribute/offer money prizes or other attractive rewards to the top performing teams (e.g. co-authorship of papers in prestigious journals, internships in prestigious labs or companies etc.). Reward and competition schemes should provide equal access for everyone to participate and encourage diversity among the participating teams.

- Collaborate with the AI on Demand Platform, the AI, Data and Robotics Partnership, the Networks of AI excellence centres[381], projects funded under CL4-2023-HUMAN-01-01, CL4-2023-HUMAN-01-03, CL4-2024-HUMAN-01-01 and CL4-2024-HUMAN-01-02, as well as other relevant initiatives.

All proposals are expected to embed mechanisms to assess and demonstrate progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring), and share 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 and re-usable (e.g. through the AI on Demand Platform) to ensure scientific and technological progress.

Financial support to third parties: A minimum of 50% of the EU funding requested by the proposal should be allocated to the purpose of financial support to third parties.

HORIZON-CL4-2023-HUMAN-01-05: Through AI from Disinformation to Trust (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 10.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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

[381] Projects funded under the following calls/topics: H2020-ICT48, HORIZON-CL4-2021-HUMAN-01-03HORIZON-CL4-2022-HUMAN-02-02)

	additionally be used).
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. Innovative AI solutions for trusted information production for media professionals, and 2. Innovative AI solutions for supporting trustworthy online activity of citizens, provided that the applications attain all thresholds.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [382].

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 Horizon Europe 2020/21 Work Programme, the second Horizon Europe 2023/24 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,

[382] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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. Solutions should be gender-sensitive and not perpetuate harmful stereotypes. 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 as described above. 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

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-11: Next Generation Internet Fund (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 27.00 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 27.00 million.
Type of Action	Research and Innovation Actions
Award criteria	The criteria are described in General Annex D. The following exceptions apply: The following additions to the general award criteria apply: The following additional aspects will be taken into account under Criterion 3 'Quality and efficiency of the implementation': "Capacity and proven experience of the consortium to create and grow internet commons based on open source software, hardware and standards".

Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Beneficiaries must provide financial support to third parties. The support to third parties can only be provided in the form of grants. As the main objective of the action is to support large number of third parties through open calls, the maximum amount to be granted to each third party is EUR 500 000 to allow 1/ cases where a given legal entity (e.g. large research, academic or industrial organisations) may receive several grants (e.g. from different calls) 2/ reaching the maturity level for third party's project to ensure sustainability with multiple awards. As the primary purpose of the action is to support and mobilise internet innovators, a minimum of 80% of the total requested EU contribution should be allocated to financial support to third parties, selected through open calls.

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

- A human centric internet aligned with values and principles commonly shared in Europe such as protection of privacy, inclusiveness, transparency, autonomy, openness, decentralisation and cooperation across borders.
- 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 structured eco-system of talented contributors driving the creation of new internet commons and the evolution of existing internet commons based on open source software, open standards and open hardware and designs.
- Synergies with NGI pilots as well as with other like-minded actions in Europe and outside.

Scope: The general objective is to nurture a structured human-centric internet eco-system by turning digital values into motivating challenges for top value-driven open source innovators in Europe enabling to create, mature and grow new internet commons. These commons encompass the whole internet stack (both server and device sides) 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.

Applicants should select and fund third party projects through financial support to third parties based on excellence and implement a continuous open call environment addressing the

requirements for transparency, publicity, confidentiality, fair treatment, and handling of conflict of interest. Applicants should publicise calls towards the open source communities actively influencing the course of the Internet.

The calls should aim at improving 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.

Applicants should define the mechanisms for maturing third parties' projects e.g. 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.

Applicants should detail the path to growth for third parties' projects e.g. by actively animating communities, creating momentum among like-minded efforts, defining how projects will gain critical mass and what services will be provided for reaching such stage. Proposals should also detail the strategy for standardisation.

Applicants should address the issue of longer term sustainability of the projects by providing legal hosting capabilities, advising on funding models (based on open source business models e.g. foundations) and on governance models (e.g. in relation to European strategic autonomy) integrating a maintenance strategy.

Applicants should actively manage the portfolio of funded projects and provide a coherent overall picture, describing how mature solutions are by giving details on audits made and ensuring trusted and easy deployment capabilities for each building blocks.

Applicants 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.

Applicants should create the conditions for successful collaboration with NGI pilot actions as well as other ongoing NGI actions such as the outreach office and ongoing research and innovation actions in the area of trust, search, architecture, blockchain and international.

Applicants should seek active collaborations with like-minded funding efforts addressing internet commons at national, European levels and beyond Europe including with European technology industries.

Applicants 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.

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

Financial support to third parties

The proposal should detail the calls logic including criteria for eligibility and award, procedure for awarding, eligible costs, third parties' costs calculation and maximum per calls. Third parties will be funded through projects typically in the EUR 50 000 to 150 000 range per project, with indicative duration of 9 to 12 months.

The consortium should provide the programme logic for the third-party projects, managing the projects life-cycle, and provide the necessary technical and non-technical support: these tasks cannot be implemented using the budget earmarked for the financial support to third parties.

The Commission considers that proposals in this topic with an overall duration of typically 42 months would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations.

HORIZON-CL4-2023-HUMAN-01-12: Pilots for the Next Generation Internet (IA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 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 14.00 million.
Type of Action	Innovation Actions
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Beneficiaries must 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 60 000. A minimum of 15% of the total requested EU contribution should be allocated to financial support to third parties, selected through open calls.

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.

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 SSH experts and 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 requirements. Issues around inclusiveness and gender-sensitivity in the developed solutions should be addressed, where relevant.

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 should 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: Next Generation Internet International Collaboration - USA (RIA)

Specific conditions	
Expected EU contribution per	The Commission estimates that an EU contribution of around EUR 4.00 million would allow these outcomes to be addressed appropriately.

project	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 4.00 million.
Type of Action	Research and Innovation Actions
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Beneficiaries must provide financial support to third parties. The support to third parties can only be provided in the form of grants. As the main objective of the action is to support collaboration between third parties and NSF-funded US teams, the maximum amount to be granted to each third party is EUR 150 000. to allow 1/ matching the project size and funding of NSF - US teams, 2/ reaching the maturity level for third party's projects to ensure sustainability of the established collaborations. A minimum of 80% of the total requested EU contribution should be allocated to financial support to third parties, selected through open calls.

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.
- Reinforced collaboration and increased synergies between the Next Generation Internet (NGI) and the Internet programmes of the US National Science Foundation (NSF).
- Enhanced EU-US cooperation in the development of Next Generation Internet technologies, services and standards. Developing interoperable solutions and joint demonstrators, contributions to standards
- A transatlantic ecosystem of 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.
- Generate new business opportunities for European Internet innovators based on decentralised technologies and open source.

Scope: The aim of the topic is to reinforce EU-US cooperation in the area of Next Generation Internet, and to establish a continuous dialogue among the actors involved in the US and EU research and innovation programmes. This will be achieved through the implementation of R&I projects between European NGI researchers and innovators, and entities participating in Internet related projects funded by NSF

Proposals should organise open calls for third party projects involving EU teams together with NSF-funded US teams on emerging topics for the EU Next Generation Internet and corresponding US programmes. The thematic focus should be on trust and privacy enhancing technologies, data sharing and portability, sustainable and climate-friendly internet, electronic identities, internet architecture renovation and decentralised technologies. The third party projects should focus on research leading to advanced technology development, and may include joint demonstrators and joint contributions to standards.

The proposal should support open source software and open hardware design. Applicants are encouraged to support, open access to data, access to testing and operational infrastructures as well as an IPR regime ensuring lasting impact and reusability of results.

Proposals should implement three open calls and should make provisions for the coordination with NSF of these open calls in terms of scope, proposals submission and selection, as well as implementation of the third party projects. The details should be agreed with NSF prior to the publication of the open calls.

Proposals should make explicit the intervention logic for the area, their capacity to attract relevant organisations both in the EU and the USA, as well as their expertise and capacity in managing the full life-cycle of the open calls transparently and efficiently.

Financial support to third parties

Proposals should foresee financial support to third party projects that will contribute to enhancing EU cooperation with the USA in the development of Next Generation Internet technologies and services. Only organisations established in the EU Member States and Associated Countries should be eligible for European Commission funding through financial support to third parties.

The Commission considers that proposals with an overall duration of typically 48 months would allow these outcomes to be addressed appropriately, while allowing the implementation of three open calls for third party projects. Nonetheless, this does not preclude submission and selection of proposals requesting other durations. For ensuring focused effort, third parties should be funded through projects typically of EUR 150 000, with indicative duration of 18 months.

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-HUMAN-01-14: Next Generation Internet Commons Policy (CSA)

Specific conditions	
Expected EU contribution per	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

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

- A stronger integration of the Next generation Internet initiative, its vision and ecosystem, with the digital commons policies at national and European level
- A long-term strategy for internet commons which are critical for sovereignty and trust, based on a clear mapping of existing communities of commoners and commons
- A smooth articulation of bottom-up activities of European communities of commoners and top-down policy priorities e.g. for reaching critical mass, for the reuse of commons, and for avoiding overlaps
- A more coherent funding landscape integrating national and European dimensions from public and private sector

Scope: While internet commons are critical in our digital life their importance it is not fully reflected at the strategic level with little representation of the communities involved, lack of structure, gap between grass-root commoners and top-down sovereignty policies, fragmented funding landscape.

The scope of this support encompasses the following activities; proposals should:

- Identify active communities of commoners in Europe and monitoring of their evolution and maturity levels
- Measure the leverage effect (e.g. in funding and resources) resulting from NGI funding
- Define a strategic agenda valid for the Multi-Annual Financial Framework timeframe and planning expected maturation of the various commons incubated in NGI
- Carry out consultation to identify internet commons priorities for ensuring European sovereignty
- Develop a plan to support commoners based on their needs that would include support to navigate the funding landscape and devise a path towards a European one-stop shop
- Create and animate a group of experts in internet commons that will analyse the NGI portfolio and devise opinion on its evolution every two months. The group should be representative of European geographies, internet building blocks, commoners diversity and include representatives of NGI on-going actions
- Devise mechanisms for creating complementary and synergies with like-minded efforts at global, European and national levels including with European technology industries

- Elaborate governance models for future commons integrating European strategic autonomy policies as well as maintenance strategy
- In conjunction with NGI outreach office, organise strategic events involving key decision makers from national and European levels where the various outputs of the action are exposed and next steps discussed

Proposals should also demonstrate strong knowledge of the open source and internet commons context (e.g. funding mechanisms, methods of working, communities involved, commons life-cycle) and be familiar with the technology building blocks that make the internet.

The Commission considers that proposals with an overall duration of 36 months would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations.

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

eXtended Reality

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-21: Next Generation eXtended Reality (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 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 26.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio, grants will be awarded not only in order of ranking but at least also to the highest ranked proposal of each type (Type I Development and integration of advanced XR hardware components, Type II development of new solutions aiming to improve the user experience, skills and capacity in social and professional XR setups), provided that the applications attain all thresholds.

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

- Next generation of XR devices and applications, which are human-centred, and provide intuitive and realistic user experiences, 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, more affordable and gender-neutral 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:

i. The development and integration of advanced XR hardware components, including the use of already available technologies, such as chips, 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.

ii. 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 such as metaverse and 3D models, realistic full body avatars and intelligent agents. The solutions should also seek to enhance the

interoperability, performance and accessibility of XR experiences. The proposals should 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.

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.

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)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5.00 and 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 25.00 million.
Type of Action	Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.
Procedure	The procedure is described in General Annex F. The following exceptions apply: To ensure a balanced portfolio, grants will be awarded not only in order of ranking but at least also to the highest ranked proposal of innovation Type I Development of XR applications to support companies in all industrial ecosystems, provided that the applications attain all thresholds.

	Only one proposal will be funded for innovation Type II.
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 500 000 to further extend the application domains, guarantee reproducibility and demonstrate the integration paths for take-up by European industries. The type ii innovation action should provide financial support to 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. 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.

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[383].

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, efficiency and human-centricity. The applications should be robust, gender-neutral 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.

At least one proposal of innovation Type I will be funded.

[383] The term industry in this context encompasses all ecosystems defined in the European industrial strategy

- 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.

Only one proposal will be funded for innovation Type II.

Financial support to third parties

The type ii innovation action should provide financial support to 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.

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. Proposals should 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 should be financed outside of the minimum allocated share for 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.

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.

Third parties in type ii should 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.

HORIZON-CL4-2023-HUMAN-01-23: Supporting the emergence of an open human-centric Metaverse (CSA)

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: Projects are expected to contribute to the following outcomes:

- Europe to co-shape and promote an open, decentralised, trustworthy European and global Metaverse in line with the vision of human-centric technology set out in the EU Declaration on Digital Principles and Rights.
- A strong and competitive ecosystem, with European companies playing a leading role in the adoption and acceptance, and in the development and deployment of Metaverse technologies.

Scope: An acceleration of blending of the real world with augmented and virtual worlds is giving rise to the Metaverse, an online network of immersive and virtual worlds allowing people to interact in real time for various purposes, allowing a seamless blending of the digital and physical world. It offers an infinite array of possibilities and opportunities for many industrial and service sectors including creativity and arts as well as for citizens. At the same time, it also poses significant societal, regulatory and ethical challenges. To be in line with European values and principles, the Metaverse has to be open, human-centric, trustworthy, safe and ethical, offering opportunities to everyone, focusing not only on business opportunities but also on important societal challenges such as healthcare and the green transformation.

The selected proposal will contribute to the 3 important dimensions of people, technologies and infrastructure related to the European vision of the Metaverse. It will:

- contribute to structure and support the Metaverse community and stakeholders in Europe by activities such as networking, outreach, public awareness, technology watch, market analysis, standardisation efforts, and industry-academia collaboration as well as building links to national programmes and initiatives.
- organise a vast engagement process with relevant stakeholders and wide consultation with citizens and civil society on the topic of the Metaverse (expectations, opportunities, challenges, role of Europe)

- reinforce the links between the various Metaverse related elements, in particular eXtended reality and AI, Blockchain, Connectivity but also any other related technologies (such as for example simulation, 3D digitisation, 5G/6G, internet technologies, cloud computing, identity management, advanced microelectronics), ensuring transfer of knowledge and community building.

- support the development of an EU strategy and roadmap towards an open human-centric Metaverse, including the identification of priority areas and application areas with a strong public dimension that would require strong public support and public and private investments

- help with the definition of industry standards for the Metaverse, guarantying interoperability, openness and seamless integration with and between applications, systems, technologies, data and platforms

- identify the main the elements of continuity as well as the differences between the internet as it operates today and the expected trends for the emerging Metaverse.

- identify ethical, legal, societal and economical aspects of the Metaverse such as the ownership of the digital identity and help Europe to tackle these challenges in line with the EU Declaration on Digital Principles and Rights.

- identify IPR and governance models supporting the human-centric vision for the metaverse, and explore the potential of models based on open source for the metaverse.

- closely collaborate and build synergies with other existing related European initiatives such as the AR/VR coalition, the eXtended Reality Ethics, Interoperability and Impact CSA funded under HORIZON-CL4-2021-HUMAN-01-28, the Common European Data spaces funded under DIGITAL (for example Cultural heritage and Media), the relevant European Partnerships (such as Data, AI and Robotics; Photonics, the European Blockchain Partnership); Next Generation Internet (NGI) initiative, the European Flagships (such as Graphene), the EU supported digital twins initiatives (such as Destination Earth).

- support international cooperation, in particular in relation to interoperability and standardisation.

European standards for industrial competitiveness

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-65: Support facility for digital standardisation and international cooperation in digital partnerships (CSA)

Specific conditions	
Expected EU	The Commission estimates that an EU contribution of around EUR 1.50

contribution per project	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 1.50 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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [384].

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 project beneficiaries should engage with relevant entities working in ICT standardisation from Japan, South Korea, Taiwan, Singapore, Canada, Australia, and the 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:

- 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.

- Coordinating with those partner countries to align our positions on digital standardisation in international standardisation organisations and other international fora.

- Monitoring the effective implementation of international standards in **trade and cooperation agreements** with such targeted countries.

[384] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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.

- Proposals should cover the following 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.

HORIZON-CL4-2023-HUMAN-01-66: Promoting EU standards globally (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 2.50 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 2.50 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: Legal entities established in all African Union member states[385] may exceptionally participate in this Coordination and support action as a beneficiary (or affiliated entity). Due to the scope of this topic, all African Union member states[386] are exceptionally eligible for Union funding.

385 "African Union member states" includes countries whose membership has been temporarily suspended
386 "African Union member states" includes countries whose membership has been temporarily suspended

Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [387]. 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 50000. FSTP should be eligible to third parties in India, Southeast Asia, the African Union, Latin America and Caribbean (LAC), the Western Balkans and the Eastern Partnership. The capacity building in third countries is expected to be done, among others, through the funding of micro-projects that may involve local stakeholders. Therefore, a minimum of 40% of the total requested EU contribution should be allocated to financial support to third parties (FSTP).

Expected Outcome: Building on the successful action of the first phase of the FPI InDiCo 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) understanding standardisation ecosystems and when relevant fostering **capacity building** in third countries **for ICT/digital standardisation around EU values.**

The targeted countries and regions are India, China, Southeast Asia, the African Union, Latin America and Caribbean (LAC), the Western Balkans and the Eastern Partnership.

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:

[387] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

1. **Enhancing the cooperation with selected countries participating in InDiCo** (India, China, Brazil and LAC region), **and extending its geographic scope** to important areas where the EU position should be reinforced such as the Western Balkans, the Eastern Partnership, Southeast 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), circular economy or smart cities.

3. **Understanding of the third countries' standardisation ecosystem and when relevant capacity building in terms of digital standardisation**, **facilitating alignment around EU values** and positions in international digital SDOs and other international fora (e.g. 3GPP, oneM2M, IETF, IEEE).

Proposals should build on the outcomes achieved in the first phase of InDiCo, as well as in the experience gained and the studies and action that have been implemented.

Due to the strategic importance for the EU interests, proposals should include European experts on standardisation, with excellent knowledge of the European Standardisation Organisations (CEN, CENELEC and ETSI) and their international activities.

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. Expertise in SSH is important in the context of this project to defending EU values and ethics and supporting the UN Sustainable Development Goals.

Proposals should address the following 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.

Digital Humanism and human compatible technologies

Proposals are invited against the following topic(s):

HORIZON-CL4-2023-HUMAN-01-81: Digital Humanism - Putting people at the centre of the digital transformation (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 1.50 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 1.50 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [388].

Expected Outcome:

[388] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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 European 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.

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).

HORIZON-CL4-2023-HUMAN-01-82: Art-driven digital innovation: Towards human compatible and ecologically conscious technology (CSA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3.00 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 3.00 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. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [389]. Financial Support to Third Parties (FSTP) is foreseen. STARTS residencies: The consortium will provide grants to artists (maximum EUR 40 000 per grant, in total between 400.000 and 600.000 EUR for FSTP in the form of grants). STARTS prize: For three consecutive years, the consortium will hand out annually two prizes of EUR 20 000 each (in total 120.000 EUR for FSTP in the form of prizes).
Other requirement	**Social Sciences and Humanities (SSH):** This topic encourages a radically new approach to inclusion of humanities in R&I by focussing on contributions of the artistic community to development and use of digital technologies that immerse digital more gracefully in economy and society and tackle the Green Transition in the spirit of the New European Bauhaus.

Expected Outcome: This call encourages a mind change regarding the role of the arts in R&I in the spirit of a European innovation policy based on culture and values. It is building on results of the S+T+ARTS program that has demonstrated concrete benefits of art-technology collaboration for digital innovation and uptake of digital in society and economy.

a. Facilitate artistic experimentation with (digital) technologies to accelerate development and novel use cases of digital technologies. The emphasise will be on ecologically conscious and human compatible technologies and use cases of technologies.

[389] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

To this end, the consortium will fund (via FSTP in form of grants) S+T+ARTS residencies of artists to be hosted by EC funded projects, technology institutions, or SMEs/industrial actors (both digital providers and end-users of digital). In the spirit of the topic, hosts of residencies must provide access to technology free of cost. The consortium will mentor residencies and help in follow-up/exploitation of the outcomes (commercial or other). Non-exclusive examples of intended outcomes include:

- Art-driven development and use of human compatible Artificial Intelligence (AI) in spirit of the EC communication on '*Trustworthy AI'*
- Art-driven applications of high-performance computing (visualisation, simulation etc).
- Art as a catalyst for uptake of the digital in society and economy in the spirit of digital innovation hubs.
- Art-driven use of technology to facilitate the Green Transition and contribute to UN Sustainable Development goals in the spirit of the '*New European Bauhaus'* (urban development, green manufacturing, circular economy, water management, etc.)
- Art-driven use of digital media to fight disinformation, for example to promote factual narratives and change behaviour in context of Green Transition and climate change.

    - b. Continuation of the annual S+T+ARTS prize: Achieve visibility of successful art and technology collaborations via an annual prize (FSTP in form of prizes) in two categories - to be defined by proposers, organize annual calls (launch, evaluation) and disseminate the prizes and its winners in an award ceremony and a travelling exhibition

    - c. Organise an annual AI and music S+T+ARTS Festival. The festival will highlight synergies of digital – in particular AI - with human creativity in art and music. Artistic use of digital can push limits of digital technology and is considered a measure of compatibility of digital with human values and needs.

Scope: While Europe is strongly pushing innovation based on technological and scientific progress, it has always put social and ecological priorities on the same level as economic growth. This has led to a new alliance of the arts with S&T as part of a European innovation policy rooted in values and culture. Artists become key drivers of 'art-driven innovation' towards ecologically conscious and human compatible technologies. In this spirit, DG CONNECT launched S+T+ARTS - innovation at the nexus of Science, Technology and the ARTS – and the European Commission president proposed the '*New European Bauhaus',* where synergies between art and novel technologies are identified as enablers of the Green Transition. The present call will thus encourage actors in R&I to adopt artistic experimentation as a complementary method for technology development and use across all EC programs.

The Commission considers a duration of 36 months as appropriate.

Call - A human-centred and ethical development of digital and industrial technologies

HORIZON-CL4-2024-HUMAN-01

Conditions for the Call

Indicative budget(s)[390]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[391]	Indicative number of projects expected to be funded
		2024		
Opening: 15 Nov 2023 Deadline(s): 19 Mar 2024				
HORIZON-CL4-2024-HUMAN-01-06	RIA	30.00	9.00 to 10.00	3
HORIZON-CL4-2024-HUMAN-01-07	RIA	20.00	Around 5.00	4
HORIZON-CL4-2024-HUMAN-01-34	CSA	5.00	1.50 to 5.00	3
HORIZON-CL4-2024-HUMAN-01-61	CSA	6.00	Around 6.00	1
Overall indicative budget		61.00		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex

390 The Director-General responsible for the call may decide to open the call up to one month prior to or after the envisaged date(s) of opening.
The Director-General responsible may delay the deadline(s) by up to two months.
All deadlines are at 17.00.00 Brussels local time.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

391 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

	D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Leadership in AI based on trust

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-HUMAN-01-06: Explainable and Robust AI (AI Data and Robotics Partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 9.00 and 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 30.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
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.

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

- Enhanced robustness, performance and reliability of AI systems, including awareness of the limits of operational robustness of the system
- 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[392], 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[393].

Multidisciplinary research activities should address all of the following:

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392 A European approach to artificial intelligence | Shaping Europe's digital future (europa.eu)

393 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

- Proposals should involve appropriate expertise in all the relevant disciplines, and where appropriate Social Sciences and Humanities (SSH), including gender and intersectional knowledge to address concerns around gender, racial or other biases. etc.

- Proposals are expected to dedicate tasks and resources to collaborate with and provide input to the open innovation challenge under HORIZON-CL4-2023-HUMAN-01-04 addressing explainability and robustness. Research teams involved in the proposals are expected to participate in the respective Innovation Challenges.

- 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.

In order to achieve the expected outcomes, international cooperation is encouraged, in particular with Canada and India.

HORIZON-CL4-2024-HUMAN-01-07: Collaborative intelligence – combining the best of machine and human (AI Data and Robotics Partnership) (RIA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 20.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).

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.

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

- **Demonstrate the value of human-machine collaboration and interaction** by improved effectiveness, intuitiveness, efficiency, completeness, limits of knowledge indication and other objective or quantifiable subjective measures.

- **Demonstrate how 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).

Proposals are expected to address at least one of the expected outcomes.

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

- Advancing human-machine collaboration and interaction - operational for a broad range of AI-reasoning systems and applicable to a broad range of application areas of AI.

At least one proposal will be selected with a focus on **human-machine collaboration and interaction** and at least one with a focus on **collaborative decision-making**. Proposals should clearly mention which of the two areas they address.

Multidisciplinary research activities should address all of the following:

- Proposals should involve appropriate expertise in Social Sciences and Humanities (SSH), including knowledge on gender and intersectional inequalities.
- Research should build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed, notably through the implementation of the FAIR data principles and adopting standardised and discipline-oriented metadata schemas and ontologies.
- Proposals are expected to dedicate tasks and resources to collaborate with and provide input to the open innovation challenge under HORIZON-CL4-2023-HUMAN-01-04 addressing explainability and robustness. Research teams involved in the proposals are expected to participate in the respective Innovation Challenges.
- Projects should also 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, and gender-sensitivity should be considered, where relevant.

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.

Systemic approaches for accelerating uptake of technology and innovation

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-HUMAN-01-34: Support for transnational activities of National Contact Points in the thematic areas of Digital, Industry and Space (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.50 and 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 5.00 million.
Type of Action	Coordination and Support Actions
Eligibility conditions	The conditions are described in General Annex B. The following exceptions apply: 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).
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [394].

Objective: [The approach and budget for this support will be implemented through the 2024 amendment, once information is available from the three ongoing NCP networks of Cluster 4.]

European standards for industrial competitiveness

Proposals are invited against the following topic(s):

HORIZON-CL4-2024-HUMAN-01-61: Facilitate the engagement in global ICT standardisation development (CSA)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 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 6.00 million.
Type of Action	Coordination and Support Actions
Eligibility	The conditions are described in General Annex B. The following

[394] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

conditions	exceptions apply: 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).
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, allowing a beneficiary fully to explore an application. As the primary purpose of the action is to support EU and Associated Countries experts in the global ICT standardisation scene, a minimum of 70% of the total requested EU contribution should be allocated to financial support to third parties, selected through open calls. Financial support for these specialists should be typically in the order of EUR 1.000 – 10.000 by use financial support to third parties (FSTP). Beneficiaries will define the process of selection of specialists through open calls. They 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. Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [395].

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;

[395] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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[396] and meeting the objectives of the European Green Deal and Europe's Digital Decade, 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. This action will among the others support the Commission's effort to address the critical issues related to internet, trusted and secured chips, or data standards as described in the EU Standardisation Strategy.

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, societal stakeholders and Academia) in key international and global Standard Developing Organisations[397]. In particular, the project should foresee actions related to topics in the Rolling Plan for ICT standardisation as well as related to internet standardisation.

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, proposals under this topic should provide for:

- 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.

396 Ref.
397 Such us ISO, IEC, ISO/IEC JTC1, ITU-T, 3GPP, IETF, OneM2M, W3C, OASIS, IEEE

- 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 activities in relation to international standardisation including in global ICT SDOs, fora and consortia.

- When relevant, support financially the hosting standardisation meetings and workshops in Europe to ease the participation of European experts;

- Facilitation of a foresight committee, which liaises with relevant on-going developments in EU and national Member States 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).

In order to achieve the expected outcomes, international cooperation is strongly encouraged.

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

Financial support to third parties

In order to set up a management facility to support contributions and leadership (e.g. chairing of technical committees, convenor positions) of European specialists, beneficiaries may provide financial support to third parties.

OTHER ACTIONS NOT SUBJECT TO CALLS FOR PROPOSALS

Grants to identified beneficiaries

1. Management and Coordination of the European partnership Globally Competitive Space Systems

Specific conditions	
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [398].
Admissibility conditions	The conditions are described in General Annex A. The following exceptions apply: The page limit of the application is 33 pages.

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 European 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 significantly contribute to the development of competitive end-to-end systems for satellite communication and Earth observation and smart technologies for European launcher systems. Thus, the Partnership activities strengthen key assets for the EU policies on climate, environment, transport, agriculture and secure society.

The project is expected to contribute to the successful set-up and initial operation of the Space Partnership.

[398] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

Scope: The central day-to-day business of this partnership will focus on stakeholder consultation, roadmap and activities definition, dissemination activities and community building. The main tasks of this action are therefore the following:

- 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 relevant entities in Member States and Associated Countries on the design of the roadmaps. Dedicated actions in relation to the involvement of entities from widening countries should also be considered.
- Update and maintenance of the SRIA (Strategic Research and Innovation Agenda) for the Partnership
- Reporting and dissemination of Partnership activities, and support of the community building

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

Legal entities:

SPACE - Space Partnership Association for the Competitiveness of Europe, 100 Rue du Trône, 1050 Brussels, Belgium

The founding members of the association SPACE as defined by its statutes

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 1.50 million from the 2023 budget

2. Developing large-scale quantum Computing platform technologies (SGA)

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 should 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.

Activities are expected to start at TRL 4-5 and achieve TRL 6-7 by the end of the project – see General Annex B.

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.

Funding rate: 100%

Minimum contribution: 25.000.000 EUR

Maximum contribution: 25.000.000 EUR

Expected grants: 1

Eligibility conditions - Participation is limited to legal entities established in Member States, Iceland, Norway and the following associated country: Israel

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 and the following associated country: Israel. [399]

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 [400]

Form of Funding: Grants not subject to calls for proposals

Type of Action: Specific grant agreement awarded without call for proposals in relation to a Framework Partnership Agreement

Indicative timetable: Second quarter of 2024

Indicative budget: EUR 25.00 million from the 2024 budget

3. Presidency Event 2024

Expected Outcome: Informing of and providing a platform to debate and implement the digital policies of the European Commission with stakeholders and Members States, in particular the implementation of the Digital Decade.

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399 Legal entities established in Israel are eligible to participate in this action on the basis that (i) Israel is an associated country (and continues to be on the date of the opening of this topic for submission); and (ii) Israel meets specific conditions. Prior to the adoption of this Work Programme, questionnaires were sent to non-EEA associated countries and countries in the process of association in order to assess their eligibility to participate.

400 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.

Scope: Two days of discussions on European digital issues and trends with high level Digital Policy decision makers at Member State, European and international level. This grant will be awarded without a call for proposals according to Article 195(e) of the Financial Regulation and Article 24 of the Horizon Europe Regulation.

Procedure – Evaluation Carried out by EU Staff: The evaluation committee will be composed fully of representatives of the European Commission.

This particular conference, organised by DG CONNECT and the rotating Presidency of the Council of the European Union since 2011, is an outreach event on the EU's digital policies, bringing together a wide range of digital stakeholders. This event is co-funded and co-organised by the European Commission and the rotating Presidency of the Council, the latter of which is the named beneficiary of the grant in question (usually via a Member State Ministry). Colleagues from the European Commission are best placed to evaluate proposals related to the organization of an event like the Digital Assembly, which is focused on digital policies and is organised by the Commission and the Presidency.

Legal entities:

Responsible ministry or agency of the EU Member State holding the Presidency

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative timetable: First or second quarter of 2024

Indicative budget: EUR 0.50 million from the 2023 budget

4. Presidency Event 2025

Expected Outcome: Informing of and providing a platform to debate and implement the digital policies of the European Commission with stakeholders and Members States, in particular the implementation of the Digital Decade.

Scope: Two days of discussions on European digital issues and trends with high level Digital Policy decision makers at Member State, European and international level. This grant will be awarded without a call for proposals according to Article 195(e) of the Financial Regulation and Article 24 of the Horizon Europe Regulation.

Procedure – Evaluation Carried out by EU Staff: The evaluation committee will be composed fully of representatives of the European Commission.

This particular conference, organised by DG CONNECT and the rotating Presidency of the Council of the European Union since 2011, is an outreach event on the EU's digital policies, bringing together a wide range of digital stakeholders. This event is co-funded and co-organised by the European Commission and the rotating Presidency of the Council, the latter of which is the named beneficiary of the grant in question (usually via a Member State Ministry). Colleagues from the European Commission are best placed to evaluate proposals related to the organization of an event like the Digital Assembly, which is focused on digital policies and is organised by the Commission and the Presidency.

Legal entities:

Responsible ministry or agency of the EU Member State holding the Presidency

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative timetable: First or second quarter of 2025

Indicative budget: EUR 0.50 million from the 2024 budget

5. European Startup Nations Standard

European SMEs and startups face several challenges 'on the ground' as they pursue ambitions of securing market opportunities and growing their revenues. Many European countries are already pursuing best practices to help startups address challenges such as making it easier to start-up and expand across borders, streamline visa and residency applications for third country talent, make granting of employee stock options more attractive, promote venture-building and tech transfer from universities, and increase access to finance for scaling-up. The Startup Nation Standard was announced as a key action in the European Commission's SME Strategy. Subsequently the European Commission together with the MS established an initial set of Startup Nation Standards. The action was launched politically at the March 2021 Digital Day event under the PT EUCO presidency through a declaration calling for commitments from Member States and EEA countries to implement such practices at national levels. In order to regularly monitor progress of countries in achieving the Startup Nations Standards, support is needed for its implementation.

The action does not fall under the scope of a call for proposals as ESNA is the implementation vehicle for an EC-launched policy initiative, that has been signed up to by 27 countries (EU Startup Nations Standard, launched by Commissioner Breton at Digital Day event in March 2021) and the support to be provided from WP23-24 will help transition ESNA's legal status

and its operations from a non-profit under PT law to a European Digital Infrastructure Consortium (EDIC, another EC-initiated instrument) that would give ESNA European legal framework for its activities and operations.

Expected Impact: It is expected to be a catalyst for reform in member states and to drive their delivery of framework conditions adapted to the needs of high growth startups and contribute to making Europe the most attractive Startup and Scaleup continent. The funding will allow the EUROPE STARTUP NATIONS ALLIANCE to scale up its operations as a European Digital Infrastructure Consortium.

Expected Outcome: The supporting service provider will develop the method, benchmark, ensure broad outreach and communication with startup stakeholders across Europe, oversee tracking and report on progress of Signatory Countries in achieving the Startup Nations standard of excellence.

Scope: The initiative will focus on the set of standards agreed by the country signatories to the Startup Nations Standard political declaration.

This grant will be awarded without a call for proposals according to Article 195 (e) of the Financial Regulation and the relevant provisions of the Horizon Europe Framework Programme and Rules for Participation to the legal entity identified below as it has been agreed by the signatory EU and EEA countries that it will implement the action on their behalf in cooperation with the European Commission.

Funding Rate: 100%

Legal entities:

EUROPE STARTUP NATIONS ALLIANCE, Rua da Horta Seca 15 1200-221 Lisboa Portugal

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative timetable: Third or fourth quarter of 2024

Indicative budget: EUR 1.00 million from the 2024 budget

6. Presidency event (conference) in Belgium: Industrial Technologies 2024

Events of a major strategic nature, which are focused and attract a broad spectrum of stakeholders are important in assessing past activities, identifying policy options and priorities, and planning future actions.

The European Commission will support the organisation of an event (conference) in Brussels in the first half of 2024, in cooperation with the Belgian government, holding the EU Presidency of the European Union at the time.

The conference should cover in particular the twin green and digital transformation of European industry. It should focus on how breakthrough technologies and scale up of industrial innovations could influence such twin transition.

It should enhance synergies between research and innovation initiatives launched by the Commission and by the Member States. The proposed content should be balanced, encompassing policy, technological, economic and social elements and points of view. The conference should be open to participants outside the EU. Outreach activities may be included, such as a press programme; activities dedicated to the wider public or schools are particularly encouraged.

To ensure impact, the focus and content of the conference should be well defined and clearly aligned with other Presidency events already undertaken, while reflecting specific regional strengths and needs.

The commitment of the national authorities to support the event, politically as well as financially, is a pre-requisite to submitting a proposal. Proposals should be supported by the competent Minister, evidenced in a letter included in the proposal. In order to ensure high political and strategic relevance, the active involvement of the competent national authorities will be assessed in the evaluation.

In agreement with the Commission services, projects should ensure appropriate flexibility, so as to respond to rapidly changing policy scenarios.

The event is expected to result in: improved visibility of industrial technologies; identification of policy options and priorities via review and assessment of developments, and sharing of information and comparison of points of views; and efficient networking of various stakeholders and support to their activities, e.g. industry, small and medium sized enterprises, businesses, investors, local authorities, non-governmental organisations, trade unions, etc..

This event is co-funded and co-organised by the European Commission and the rotating Presidency of the Council, the latter of which is the named beneficiary of the grant in question (usually via a Member State Ministry).

The evaluation committee will be composed fully by representatives of EU institutions.

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative timetable: 2024

Indicative budget: EUR 0.10 million from the 2023 budget

7. Presidency Event (conference): Industrial Technologies 2025

This event will cover aspects of industrial technologies.

This event is co-funded and co-organised by the European Commission and the rotating Presidency of the Council, the latter of which is the named beneficiary of the grant in question, via a responsible ministry or agency of the EU Member State holding the Presidency.

The evaluation committee will be composed fully by representatives of EU institutions.

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative timetable: 2025

Indicative budget: EUR 0.10 million from the 2024 budget

8. ICT Event 2024

The details of this event are under development but its concept will likely revolve around a physical (+hybrid when appropriate) event focusing on digital-related funding opportunities and match-making. The involvement and active support of the relevant National Contact Point networks will be a key aspect of the initiative.

The evaluation committee will be composed fully by representatives of EU institutions.

Procedure – Evaluation Carried out by EU Staff: The evaluation committee will be composed fully of representatives of the European Commission.

This particular conference, organised by DG CONNECT and the rotating Presidency of the Council of the European Union, is an outreach event on the EU's digital policies and funding opportunities, bringing together a wide range of digital stakeholders, offering brokerage and

match-making opportunities. This event is co-funded and co-organised by the European Commission and the rotating Presidency of the Council, the latter of which is the named beneficiary of the grant in question (usually via a Member State Ministry). Colleagues from the European Commission are best placed to evaluate proposals related to the organization of such an event, which is focused on digital policies and is organised by the Commission and the Presidency.

Form of Funding: Grants not subject to calls for proposals

Type of Action: Grant to identified beneficiary according to Financial Regulation Article 195(e) - Coordination and support action

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 0.50 million from the 2023 budget

9. SSA-SST Specific Conditions

YEAR	2024
Specific conditions applying to each of the following actions: **HORIZON-CL4-2024-SSA-SST-MS** **HORIZON-CL4-2024-SSA-SST-STM-AE** **HORIZON-CL4-2024-SSA-SST-SB** **HORIZON-CL4-2024-SSA-SST-SP** **HORIZON-CL4-2024-SSA-SST-SD**	
Technology Readiness Level	TRLs are expected to achieve TRL 6-7, but detailed TRLs will be specified according to SST project development needs and achievements of previous research activities.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. The following exceptions apply: **Lower funding rates** The funding rate of the eligible costs is defined in the description of each action.

	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.
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).

10. HORIZON-CL4-2024-SSA-SST-MS - New & improved EUSST Missions and Services

Expected Outcomes:

This Space Surveillance and Tracking (SST) topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its outcomes are expected to build on previous and ongoing actions and aim at achieving full capacity of the EUSST Partnership by end 2024.

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 U.S. 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 to protect active European satellites have to be adapted to these new challenges and needs to strengthen European autonomy in the SST field. 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 EU knowledge and capabilities in 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 in line with future user needs and the 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, for example (non-exhaustive list):

1. debris mitigation;
2. debris remediation;
3. potential hazardous objects identification;
4. potential synergies with other EU Space Programme components (e.g. current and future Galileo services; Data authentication mechanism; timing service; High Accuracy Service, etc.);
5. inter-orbit RFI anticipation;
6. post-manoeuvre analysis;
7. support to EOL operation;
8. etc.

- Explore the implementation of new services, in complementation to the three existing ones.
- Support pre-developments and end-to-end early demonstration of new SST services.

Scope:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its scope is expected to build on previous and ongoing actions and aims at achieving full capacity of the EUSST Partnership by end 2024.

R&I activities which need to be addressed in order to tackle the above expected outcomes are:

1. R&I on evolution of the Collision Avoidance service towards a higher responsiveness in 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 generation of space debris;
3. R&I on evolution of the EUSST system for space debris remediation by managing existing space debris.
4. R&I on evolution of the EUSST Service Provision Portal in line with the evolution of existing services (CA, RE, FG) and the inclusion of new ones (e.g. debris mitigation / remediation).

As the legal entities (the "Constituting National 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 (EU) 2021/696 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 (EU) 2021/696 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.

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

Implementation: Research and Innovation Action (RIA).

Note: specific conditions apply to this action.

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)

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 6.00 million from the 2024 budget (Research and Innovation Action)

11. HORIZON-CL4-2024-SSA-SST-AE - SST & STM system architecture and evolutions

Expected Outcomes:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its outcomes are expected to build on previous and ongoing actions, and aim at achieving full capacity of the EUSST Partnership by end 2024.

The environment in which the EUSST system performs its mission and delivers its services is constantly evolving due to e.g. technological or political factors changing the way in which space is used, orbital environment, etc.

EUSST system architecture engineering & evolutions: the analysis of the EU SST system architecture needs to continuously progress to determine how the system has to evolve in the

medium- and long-term at network level (type, performance, number, geographical localisation, etc. of assets), data processing level and services level. Other aspects like data flows, security constraints, interconnectivity and complementarity between EU assets as well as cooperation with other non-European SST systems need to be considered as well.

More generally, the reliance of our society, economy and security on space-based data and services, in particular thanks to the success of Copernicus and Galileo European programmes, has been rapidly growing. At the same time, the emergence of new types 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, further increasing the risk of collisions and radiofrequency interferences.

The importance of SST / STM (Space Traffic Management) is thus growing, even more so in the absence of clear definitions, of common global regimes and systems, of agreed flight rules and of associated monitoring/enforcement means at international level.

Therefore, projects developed under this topic are expected to contribute to the following outcomes:

- Foster European cooperation in the SST domain and improve EUSST performance with a view to achieving a higher level of autonomy.
- Highlight and propose solutions to fill the gaps in the current EUSST architecture.
- Pave the way in which the EUSST system has to evolve towards a higher level of performance (e.g. increased accuracy, increased number of catalogued objects, reduced size of catalogued objects, reduced orbit age of catalogued objects), quality of service (e.g. timeliness of information) and autonomy.
- Evaluate and justify the complementarity, coherence and added value of each element of the EUSST system in light of a more autonomous, interoperable SST system.
- Explore and look for higher levels of cooperation with other SST systems such as the U.S. SSA system which is of paramount importance to develop long-term cooperation.
- Raise main issues resulting from the STM coordination and support actions under H2020, and propose solutions in line with technical and operational developments.
- Propose solutions to adapt to new challenges, and envisage their integration into existing standards, practices and technological means.

Scope:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its scope is expected to build on previous and ongoing actions and aims at achieving full capacity of the EUSST Partnership by end 2024.

R&I activities which needs to be addressed in order to tackle the above expected outcomes are :

1. EUSST architecture engineering.
2. Improve the future EUSST architecture and the associated development roadmap offering the highest performance, European autonomy and best value for money.
3. Carry out architecture studies and system design to validate the added-value of all layers of the EUSST system.
4. Define and set up efficient and relevant performance criteria, “metrics”, “Key Performance Indicators” and “critical success factors” (e.g. size, accuracy and age of European catalogue; timeliness of data provision by sensors; timeliness of service provision; etc.).
5. Improve SST system architecture simulation tools.
6. Carry out activities/studies in the area of support to spacecraft manoeuvres, interference management, collision avoidance automation.
7. Carry out activities/studies in space object life cycle and risk assessment.
8. Assess and pre-develop technologies for object identification, navigation aids and servicing interfaces.
9. Contribute to technical standardisation activities in these areas.

As the legal entities (the “Constituting National 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 (EU) 2021/696 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 (EU) 2021/696 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.

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

Implementation: Research and Innovation Action (RIA)

Note: specific conditions apply to this action.

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)

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 6.00 million from the 2024 budget (Research and Innovation Action)

12. HORIZON-CL4-2024-SSA-SST-SB - Space-based SST (mission, system and sensors network)

Expected Outcomes:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its outcomes are expected to build on previous and ongoing actions and aim at achieving full capacity of the EUSST Partnership by end 2024.

With a growing orbital population and the need to observe smaller objects in order to be able to better protect EU space assets, the need for and added-value of developing Space-Based Space Surveillance (SBSS) missions in complementation to ground-based SST sensors should be studied in Europe. Based on the experience of SBSS missions launched and operated outside Europe , space-based SST missions and sensors networks will have to be included into EUSST in order to increase the EU ability to observe and catalogue objects in various orbits and to compensate for limitations linked to geographical location, light and weather conditions of ground-based 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 future European SBSS capabilities.
2. Explore the use of small satellite solutions to reduce capital expenditures CAPEX and operational expenditures OPEX.
3. In the medium-term, develop European capacities to operate SBSS independently.
4. Reduce dependence on critical SBSS technologies and capabilities from outside Europe.

Scope:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its scope is expected to build on previous and ongoing actions and aims at achieving full capacity of the EUSST Partnership by end 2024.

R&I activities which needs to be addressed in order to tackle the above expected outcomes are:

1. Study various mission configurations (e.g. orbit regime, orbit plan) and payload definition to maximize the number of catalogued objects and associated accuracy). Analyse EUSST gaps and solutions to fill them with best value for money.

2. Study coordination strategies and techniques among satellites of SBSS missions and terrestrial SST systems.

3. Develop or improve existing algorithms to evolve from detection to cataloguing (e.g. IOD, correlation) taking into account ground-based SST systems and payload performance (i.e. observable magnitude).

4. Explore use of non-dedicated sensors (e.g. star trackers) or hosted payloads in non-dedicated missions ("opportunistic" solutions) to reduce the costs of operation.

5. Assess security issues related to the link between SBSS and ground-based EUSST networks.

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

Implementation: Research and Innovation Action (RIA)

Note: specific conditions apply to this action.

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)

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and

operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 10.00 million from the 2024 budget (Research and Innovation Action)

13. HORIZON-CL4-2024-SSA-SST-SP - SST Sensors and Processing

Expected Outcomes:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its outcomes are expected to build on previous and ongoing actions and aim at achieving full capacity of the EUSST Partnership by end 2024.

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, etc.) technological research and innovation: due to the increased number of objects (both active and debris) to be handled, as well as the evolution of EUSST services in the future, R&I activities are necessary in the sensor domain, both for radiofrequency sensors (e.g. passive ranging, radars, etc.) and optical sensors (e.g. telescopes, innovative wide field optical sensors, lasers, etc.). New promising technologies like sensors based on the use of infrared will also be considered.

- Contribute to a consolidated and efficient EUSST sensor function.
- Improve the coverage area, geographical location and performance they can offer (e.g. field of view, limiting magnitude, frequency-band, accuracy, timeliness of the associated processing, etc.)
- Ensure an optimal evolution of the configuration and use of the EUSST sensors network, including necessary raw data processing required to provide measurement data.
- Improve the 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 and innovation (e.g. Artificial Intelligence): developments in the space environment raise the need to adapt current algorithms and data processing methods and tools as well as to look for new ones.

- Include or at least explore the possibility of using Artificial Intelligence (AI) in any SST data processing (e.g. improvement of object detection capability; of probability of collision accuracy)
- Develop automatic sensor scheduling and tasking, and data processing functions

Scope:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its scope is expected to build on previous and ongoing actions and aims at achieving full capacity of the EUSST Partnership by end 2024.

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 need to be addressed in order to tackle the above expected outcomes:

1. Adapt and improve technologies already in use in SST sensors such as radars, telescopes and lasers.
2. Improve sensors performances (e.g. measurements quality such as noise, bias, measurements rates, and tracks quality such as track accuracy, track duration).
3. Specify, develop, test and pre-integrate improved sensors.
4. Develop innovations for detection of smaller objects and higher processing capabilities (e.g. networked telescopes for LEO coverage, improved tracking by lasers in daylight).
5. Develop new detection strategies to cope with an increased number/size of objects in the sensors' Field of Regard/Field of View.
6. Explore new technologies and/or processing algorithms and techniques to develop and implement potential new services developed in HORIZON-CL4-2024-SSA-SST-MS New & Improved EUSST Missions and Services topic (e.g. support to manoeuvres, detection of malfunctioning spacecraft).
7. Improve algorithms (e.g. measurements correlation, Initial Orbit Determination, covariance estimation) for a more agile and accurate cataloguing of the growing space objects population and increasing services provision (e.g. collision avoidance, support to manoeuvres and identification of in-orbit anomalies).
8. Improve algorithms for data fusion for a more efficient use of data and information coming from different sensors on the same object.
9. Improve computation models of collision probability.
10. Develop evaluation methods for collision probability that could be applied to constellations (e.g. multiple encounters).
11. Improve or develop new object propagation models for efficient propagation of the orbital population (e.g. cloud propagation models to propagate the debris cloud generated after a fragmentation).
12. Advance coordinated scheduling and tasking of sensors to progress towards a more efficient use of multiple available resources at system level.

13. Improve algorithms for objects characterisation.

14. Consider any promising technology for precise tracking and data processing.

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

Implementation: Innovation Action with reduced funding rate (45%) (IA)

Note: specific conditions apply to this action.

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)

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 27.50 million from the 2024 budget (Innovation Action with reduced finding rate (45%))

14. HORIZON-CL4-2024-SSA-SST-SD - SST Networking, Security & Data sharing

Expected Outcomes:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its outcomes are expected to build on previous and ongoing actions and aim at achieving full capacity of the EUSST Partnership by end 2024.

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 the EUSST infrastructure based on the European network of assets (sensors, operation centres, front desk, etc.).

Although the EUSST infrastructure should 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.

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 EUSST system has to evolve into a coordinated scheduling of resources and assets, ensuring that events are covered in an optimal way while the current survey and tracking of the space objects population continues to be performed. The evolution of the EUSST network includes the Front Desk in charge of the interaction with the users (user needs, monitoring service performance, etc.).

- Raise main issues and propose solutions for the increasing complexity and missions' constraints of the EUSST network.
- Connectivity and interface consolidation of network functions between sensors / database / operating centres / front desk (reliability, maintainability and agility).
- Develop EUSST network in order to include a future SBSS segment.

Research on EUSST network hardening against external threats: Security-critical aspects of the existing EUSST network. Various external threats should be considered in the research activity (e.g. cyber threats or other malicious activity). Research specifically applying to the hardening of the EUSST 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, etc.)
- Define the need for SST-specific tools and solutions with regard to enhanced data interoperability and data security.

Scope:

This SST topic contributes to ensuring full and optimal capacity of the EUSST Partnership once the latter is set up. Its scope is expected to build on previous and ongoing actions and aims at achieving full capacity of the EUSST Partnership by end 2024.

The following R&I activities need to be addressed in order to tackle the above expected outcomes:

1. Update operation centres to improve current services (Collision Avoidance; Fragmentation; Re-entry) adapted to future user needs and the space environment.
2. Update operation centres to new missions and services (e.g. debris mitigation; debris remediation; etc.).
3. Adapt European SST network to a more efficient coordinated scheduling and tasking of resources and assets.
4. Develop new data sharing and fusion strategies and techniques adapted to both ground- and space-based SST assets.
5. Develop threat analysis and counter-measures to protect EUSST infrastructure.
6. Adapt EUSST operation centres for increasing security and resiliency.

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

Implementation: Research and Innovation Action (RIA)

Note: specific conditions apply to this action.

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)

The general conditions, including admissibility conditions, eligibility conditions, award criteria, evaluation and award procedure, legal and financial set-up for grants, financial and operational capacity and exclusion, and procedure are provided in parts A to G of the General Annexes.

Indicative budget: EUR 7.00 million from the 2024 budget (Research and Innovation Action)

Public procurement

1. 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 budget: EUR 2.50 million from the 2023 budget and EUR 2.50 million from the 2024 budget

2. Space conferences, outreach, studies and other activities

It is envisaged to conduct public procurement activities for the organisation of events (conferences, workshops or seminars) for the implementation of the European Space Policy, European R&D research agendas related to Horizon Europe.

Support may be given to the organisation of conferences and information events to strengthen wider participation in the programme (including that of third countries), and to disseminate results of European research in the Space sector. Cooperation with the presidencies of the Council of the European Union is envisaged.

Furthermore, procurement will be necessary of actions such as studies, preparation of roadmaps to underpin planning or actions to evaluate the outcomes of R&D actions.

Activities may include surveys as appropriate implemented through public procurement, and/or appointing (groups of) independent experts. This limited number of contracts may be implemented on the basis of framework contracts, in order to further ensure that the Commission is provided with appropriate and timely analyses, which in turn will facilitate the proper integration of policy studies into the preparation of new policy initiatives.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative budget: EUR 0.50 million from the 2023 budget

3. Citizens' Hackathon European Championship 2023

Expected Impact:

The objectives of this action are to:

- implement a European Championship of knowledge valorisation citizens' hackathons, drawing on the methodology for citizens' hackathons that has been developed after testing the concept through a live pan-European hackathon, see Valorising research through citicens' engagement - Publications Office of the EU (europa.eu) [401]; and
- to draw lessons (what worked well, what challenges were faced) and provide policy insights on how to strengthen citizen engagement in knowledge valorisation through participatory value creation.

The action will deliver a number of innovative solutions that are co-created with citizens across Europe, evaluated in the local hackathons, and taken further to the final at the European level where the best ideas will compete. It will directly contribute to the objectives of the ERA to transfer research results to economy and society and will provide a platform for strong citizen engagement and academia- society collaboration. It will further engage industry and public sector in the further development and uptake of the winning innovative solutions. It will therefore support the objectives of the work programme for inclusive innovation and societal acceptance of new technologies and innovative solutions. Finally, it will provide lessons and recommendations on knowledge valorisation policy, and in particular in view of a code of practice for participatory value creation for researchers.

Scope:

The action will deliver a service, that will consist of developing and testing the Citizens' Hackathon European Championship concept and providing lessons for the further development of the scheme. To implement the concept, the action will provide support for the execution of citizens' hackathons in cities and local communities across Europe that will

401 European Commission, Directorate-General for Research and Innovation, Valorising research through citizens' engagement : how to run hackathons with citizens, Pottaki, I.(editor), Publications Office of the European Union, 2022.

participate to the European Championship from all EU Member States and Associated Countries to Horizon Europe, and for the European level Final, where the winning teams of the local hackathons will compete for the European Champions.

The action will ensure that the same standards for evaluation and selection of the winning teams are applied and that the best ideas are brought forward to compete at the European level Championship. The hackathons will use online tools, and can also benefit from hybrid modes (physical and virtual participation).

The challenges to be addressed will be driven by the citizens' needs and will be scoped in relation to Cluster 4 areas.

The action will cover the local hackathon in all Member States and Associated Countries wishing to participate, with a budget of 30.000 euro for each local hackathon, as well as the European level Final.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: Q1, 2023

Indicative budget: EUR 1.00 million from the 2023 budget

4. Raw Materials Event

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

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: Q4 2023 and Q4 2024

Indicative budget: EUR 0.60 million from the 2023 budget and EUR 0.60 million from the 2024 budget

5. Digital conferences, outreach, studies and other activities

In addition to calls for proposals, other actions are also expected to be undertaken on specific activities that DG CONNECT will support. These include:

- Other events and publications (e.g. information, communication, dissemination etc.), either through the use of existing Framework Contracts, or the launch of indicatively 25 calls for tenders during 2023 and 2024. Indicative budget in 2023: EUR 1.5 million. Indicative budget in 2024: EUR 1.5 million.

- Studies including socio-economic and impact analysis studies, and studies to support the monitoring, evaluation and strategy definition for the ICT priority of Cluster 4 in Horizon Europe. DG CONNECT plans to procure via framework contracts and calls for tender indicatively 25 study contracts before the end of 2024. The calls for tenders are expected to be launched in the 2nd and 3rd calendar quarter of 2023 and 2024. It should be noted that internal outsourcing of studies to other Commission departments based on Administrative Agreements can be used as an alternative to public procurement.

- Policy support activities, including benchmarking activities, evaluation and impact assessments, the development of ad hoc support software, possibly using existing Framework Contracts. DG CONNECT plans to procure via framework contracts and calls for tender indicatively 15 contracts before the end of 2022. The calls for tenders are expected to be launched in the 2nd and 3rd calendar quarter of 2023 and 2024. It should be noted that internal outsourcing of studies to other Commission departments based on Administrative Agreements can be used as an alternative to the public procurement.

Indicative budget for Studies and Policy support in 2023: EUR 2.5 million. Indicative budget in 2024: EUR 2.5 million.

Details will be provided in the texts of these calls for tender.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative budget: EUR 4.00 million from the 2023 budget and EUR 4.00 million from the 2024 budget

6. European Standardisation Panel Survey

Expected Impact:

The European Standardisation Panel Survey (ESPS) is a survey to collect data on the standardisation activities of companies. The ESPS aims to create a comprehensive database for the analysis of the current activities and future trends for use by standardisation policy makers and any other interested parties.

The data generated by the ESPS will serve as an input for scientific research on the standardisation activities of companies, the implementation of standards, and the effects of standards on entrepreneurial success. The results of the survey can also be used to develop strategies for the involvement in European and international standardisation. The data thereby facilitates the identification of new trends.

The analyses will complement the code of practice on standardisation for researchers by raising awareness of the importance of standardisation for businesses which have not yet used formal standards or been active in standards. This requires a wide dissemination of the survey results via reports. The ESPS should thereby help to achieve the objectives of standardisation research, policy and promotion.

Scope:

For businesses standardisation serves as a strategic tool by preparing the market for a new product, even if the new product is still in the early stages of development.

Standardisation research with all of its facets – from creation, through the development process and to the implementation of the standard – has, despite progress in recent years, continued to be doomed to a shadowy existence in comparison to innovation research. This is primarily due to the fact that, despite excellent theoretical reviews on the topic, no comprehensive empirical data is available.

Against this background the first European Standardisation Panel Survey will be launched to collect and analyse data of European companies and research institutions in the field of standardisation.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: Q1, 2023

Indicative budget: EUR 0.06 million from the 2023 budget

Other budget implementation instruments

1. Project monitoring and use of individual experts (space)

This action will support the use of appointed independent experts by HaDEA for the monitoring of running space actions (grant agreement, grant decision, public procurement actions and financial instruments) funded under Horizon Europe and previous Framework Programmes for Research and Innovation and where appropriate include ethics checks as well as compliance checks regarding the Gender Equality Plan eligibility criterion..

Form of Funding: Other budget implementation instruments

Type of Action: Expert contract action

Indicative budget: EUR 0.50 million from the 2023 budget and EUR 1.00 million from the 2024 budget

2. Project monitoring and use of individual experts (Industry)

This action will support the use of appointed independent experts by HaDEA for the monitoring of running industry actions (grant agreement, grant decision, public procurement actions and financial instruments) funded under Horizon Europe and previous Framework Programmes for Research and Innovation, and where appropriate include ethics checks, as well as compliance checks regarding the Gender Equality Plan eligibility criterion.

Form of Funding: Other budget implementation instruments

Type of Action: Expert contract action

Indicative budget: EUR 1.40 million from the 2023 budget and EUR 1.40 million from the 2024 budget

3. Project monitoring and use of individual experts (Digital)

This action will support the use of appointed independent experts by CNECT and HADEA for the monitoring of running digital actions (grant agreement, grant decision, public procurement actions, financial instruments) funded under Horizon Europe and previous Framework Programmes for Research and Innovation, and include ethics checks, where appropriate, as well as compliance checks regarding the Gender Equality Plan eligibility criterion.

Form of Funding: Other budget implementation instruments

Type of Action: Expert contract action

Indicative budget: EUR 1.25 million from the 2023 budget and EUR 1.25 million from the 2024 budget

Scientific and technical services by the Joint Research Centre

1. JRC Support to Energy Intensive Technologies 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

Form of Funding: Direct action grants

Type of Action: Provision of technical/scientific services by the Joint Research Centre

Indicative timetable: Q1 2023 / 2024

Indicative budget: EUR 1.50 million from the 2023 budget

2. JRC Support to Safe and Sustainable by Design Chemicals and Materials Criteria

Objective: To continue the collaboration with the JRC on Safe and Sustainable by Design chemicals and materials. This action will focus on providing support to DG R&I during the testing phase of the SSbD framework, among other activities it will include: to provide methodological guidance to applicant of the SSbD framework during the testing phase, to evaluate the feedback received from MS and industry during the testing phase and to refine and expand the current SSbD framework based on the input collected.

Duration: 24 months

Form of Funding: Direct action grants

Type of Action: Provision of technical/scientific services by the Joint Research Centre

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 1.00 million from the 2023 budget

Subscription Actions

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 Q1 2023 and As of Q1 2024

Indicative budget: EUR 0.05 million from the 2023 budget and EUR 0.05 million from the 2024 budget

Indirectly managed actions

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

Form of Funding: Indirectly managed actions

Type of Action: Indirectly managed action

Indicative timetable: 2023

Indicative budget: EUR 3.00 million from the 2023 budget

2. Critical Raw Materials Exploration Investment Facility with the European Bank for Reconstruction and Development

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 supply of sustainably and responsibly mined, processed and transported 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.

Functioning of the blending operation

The blending operation will be open to all applicants meeting the set eligibility criteria set in this text and in the abovementioned Guarantee Agreement. As such, it is not restricted to projects proposed under pre-existing or future partnerships with the European Commission. This blending operation is particularly relevant because it seeks to bring together the public and private sector to fund pre-commercial, industry-scale demonstration projects for critical decarbonisation technologies, directly addressing the early deployment funding gap for the selected technologies and provide a structure to accelerate their commercialisation.

Projects' selection and financing procedure will be described in the guarantee agreement. In particular, the EBRD will check the financial viability of and perform full due diligence on each potential financing operation. Special attention shall be paid to ensuring that the technologies developed and Intellectual Property generated will benefit the EU interest, in particular by focussing the funds on high quality projects realised in the Union/ eligible Associated Countries.

Legal entities:

EBRD, One Exchange Square London EC2A 2JN United Kingdom

Form of Funding: Indirectly managed actions

Type of Action: Indirectly managed action

Indicative timetable: Q1 2023

Indicative budget: EUR 25.00 million from the 2023 budget

3. Indirectly managed actions delegated to ESA

ESA.1 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 (e.g. Low Earth Orbit Positioning, Navigation and Timing EOPNT), 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-the-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 on a case-by-case basis 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 the European Commission under the Financial Framework Partnership Agreement (FFPA).

Indicative budget for this action: EUR 43 million from the 2023 budget and EUR 43 million from the 2024 budget.

ESA.2 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 EU 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. This includes the development and validation of the Quantum Key Distribution (QKD) payload for the EuroQCI 1st generation satellites based on EU technologies.

These activities are due to be entrusted to 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 on a case-by-case basis 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 28 million from the 2023 budget and 20.6 million from the 2024 budget (out of which 28 million for the EuroQCI part).

ESA.3 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 the area of two-way bi-directional ground on-board, optical and radio - Ku, Ka, Q/V - links and inter-satellite links), ground control and mission (network) segment and user segment terminals, such as multi-orbit compatible broadband user terminals and government services user terminals.

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, COMPET-1-2014-2015-2016-2017, HorizonEurope 2021-SPACE-01-81, 2022-SPACE-01-81). Furthermore, activities must be complementary to national activities and activities funded by ESA, while contributing to EU non-dependence (at system, equipment and component level).

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 on a case-by-case basis 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 10 million from the 2023 budget.

ESA.4 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 for this action: EUR 15.1 million from the 2023 budget and EUR 13.0 million from the 2024 budget.

ESA.5 Space Weather and Near-Earth Objects

a) Space Weather (SWE)

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 including development, testing and validation of physics-based space weather models" 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 (NEO)

Our knowledge of the physical characteristics of the NEO population is limited. There is a need of continuously investigating the physical and dynamical properties of the NEO population as a whole, both the processes that are involved in their evolution and influence the change of their properties through time, as well as the efficiency of mitigation techniques. This can be done either through ground-based observations or through missions to asteroids (e.g. close proximity operations to NEOs or mitigation demonstration, in particular the Hera mission). It is necessary to have an arsenal of complex numerical models of involved processes, specific technologies and instruments readily available for use, to further strengthen the robustness of mitigation techniques and the scientific return of missions.

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 national assets".

Indicative budget for this action: EUR 5.7 million from the 2024 budget, split equally between SWE and NEO activities.

Legal entities:

European Space Agency (ESA)

Form of Funding: Indirectly managed actions

Type of Action: Indirectly managed action

Indicative budget: EUR 96.10 million from the 2023 budget and EUR 82.30 million from the 2024 budget

4. Indirectly managed actions delegated to EUSPA

EUSPA.1 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 on a case-by-case basis 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 5 million from the 2023 budget.

EUSPA.2 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 in 2024.

Amount: The extension of the existing contract for CASSINI Business Accelerator (Year 3+4) will be made by EUSPA in 2024 for an amount of EUR 8.50 million.

Expected Outcomes:

- The aims are to promote commercial use cases for the EU's space programme and the commercialisation of the products of New Space companies, 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 budgetfor this action: EUR 8.5 million from the 2024 budget

EUSPA.3 Support European "New Space" entrepreneurship through CASSINI Space Entrepreneurship Initiative 2021-2027 – CASSINI Hackathons & Mentoring

Implementation: the action will be implemented by the EUSPA through a call for tender in 2024 for a 2+2 year contract.

Amount: A 4 year contract for CASSINI Hackathons & Monitoring will be signed for an amount of EUR 4.80 million

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 for this action: EUR 4.8 million from the 2024 budget.

EUSPA.4 Support European "New Space" entrepreneurship through CASSINI Space Entrepreneurship Initiative 2021-2027 – CASSINI myEUspace

Implementation: the action will be implemented by the EUSPA through an existing FWC for a 2-year specific contract to be signed in Q2 2023. The action will start in Q3 2023 and will end in Q3 2025.

Amount: A 2-year contract for CASSINI myEUspace will be signed for an amount of EUR 1.0 million.

Expected Outcomes:

- To stimulate the spur-of-the-moment development of innovative commercial solutions based on data and information coming from Copernicus satellite images and Galileo positioning signals and services.
- To develop prototypes further into viable business propositions.
- To support commercialization and scale up of final products.
- To provide training opportunities on how to access and use data from Copernicus and Galileo with data analytics tools and artificial intelligence.
- To promote the EU's space programmes Copernicus and Galileo to a broader audience.
- The tasks to be outsourced will enable a more efficient implementation of the action by having a contractor to run promotional activities and scouting participants, management of the application platform, preparation of communication material, and organisation of the contest finals.

Form of Funding: Procurement

Type of Action: Public procurement (existing FWC)

Indicative budget for this action: EUR 1.0 million from the 2023 budget.

EUSPA.5 Development of applications for Galileo, EGNOS and Copernicus, PRS activities and GOVSATCOM activities

Calls for proposals under this area will address downstream R&D activities in the form of calls to proposals to be launched by the European Union Space Programme Agency (EUSPA) in accordance with the specification included in Appendix below.

We need to make the best use of EGNSS and Copernicus capacities for EU citizens, companies and society. Research and innovation should therefore foster the development of EGNSS downstream applications and promote their adoption in the EU and worldwide, in particular in markets with a long lead-time (e.g. maritime, rail, aviation), and in areas where Galileo offers unique differentiators (high accuracy, authentication, Search and Rescue, PRS).

Copernicus based applications and services can serve, for example, polar research, monitoring of the environment, maritime and coastal monitoring, natural disasters, civil security, migration and agriculture. They and can bring, with EGNSS, a key contribution to the

European Green Deal and to the sustainable management of natural resources. The public sector should be supported as customer of space based technologies via innovation procurement. Synergies between Galileo/EGNOS and Copernicus, as well as synergies with non-space programmes, leveraging the combination of space data with non-space data, will open new avenues for the creation of a wealth of new and innovative applications and services. The use of Copernicus and Galileo/EGNOS for the EOSC and DestinE initiatives, and other EU funded initiatives such as the Horizon Europe candidate partnership Agriculture of Data and Europe Soil Mission, should equally be taken into account and promoted.

PRS activities are needed for developing the user base and the applications, as well as to support the testing and validation of the PRS service, in ways that foster cooperation among European entities.

GOVSATCOM activities are needed for developing the user base, supporting the development of demonstration terminals and the validation of the services, identifying the tools needed for the future GOVSATCOM HUB services and supporting the development of applications.

Indicative budget for this action: EUR 46.5 million from the 2023 budget

EUSPA.6 Tender evaluation, project monitoring and audits (EGNSS/Copernicus downstream)

This action will support the use of appointed independent experts by EUSPA for the monitoring of running projects, tender evaluation and audits where appropriate.

Indicative budget for this action: EUR 0.50 million from the 2023 budget and EUR 0.50 million from the 2024 budget

Legal entities:

European Union Agency for the Space Programme (EUSPA), Janovského 438/2 170 00 Prague 7 – Holesovice Czech Republic

Form of Funding: Indirectly managed actions

Type of Action: Indirectly managed action

Indicative budget: EUR 53.00 million from the 2023 budget[402] and EUR 13.80 million from the 2024 budget

APPENDIX TO ACTION EUSPA.5
Specification of the call to be launched by EUSPA under indirect management during 2023

The following information is provided for information purposes.

[402] Of which EUR 25.00 million from the 'NGEU' Fund Source.

Call - STRATEGIC AUTONOMY IN DEVELOPING, DEPLOYING AND USING GLOBAL SPACE-BASED INFRASTRUCTURES, SERVICES, APPLICATIONS AND DATA 2023 - APPLICATIONS

HORIZON-EUSPA-2023-SPACE

Conditions for the Call

Indicative budget(s)[403]

Topics	Type of Action	Budgets (EUR million)	Expected EU contribution per project (EUR million)[404]	Indicative number of projects expected to be funded
		2023		
Opening: Oct 2023 (indicative) Deadline(s): Feb 2024 (indicative)				
HORIZON-EUSPA-2023-SPACE-01-41	IA	3.50	1.50 to 2.50	2
HORIZON-EUSPA-2023-SPACE-01-42	IA	8.00	1.50 to 2.50	4
HORIZON-EUSPA-2023-SPACE-01-43	RIA	7.00	1.00 to 2.00	5
HORIZON-EUSPA-2023-SPACE-01-44	IA	9.00	1.00 to 2.00	5
HORIZON-EUSPA-2023-SPACE-01-45	IA	3.00	1.50 to 3.00	2
HORIZON-EUSPA-2023-SPACE-01-46	RIA	6.00	0.80 to 1.00	7
HORIZON-EUSPA-2023-SPACE-01-61	IA	10.00	3.00 to 4.00	3
Overall indicative budget		46.50		

General conditions relating to this call	
Admissibility conditions	The conditions are described in General

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404 Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

	Annex A.
Eligibility conditions	The conditions are described in General Annex B.
Financial and operational capacity and exclusion	The criteria are described in General Annex C.
Award criteria	The criteria are described in General Annex D.
Documents	The documents are described in General Annex E.
Procedure	The procedure is described in General Annex F.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.

Development of applications for Galileo, EGNOS and Copernicus

Proposals are invited against the following topic(s):

HORIZON-EUSPA-2023-SPACE-01-41: EGNSS - Transition toward a green, smart and more secure post-pandemic society

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.50 and 2.50 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 3.50 million.
Type of Action	Innovation Actions
Eligibility conditions	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).
Technology Readiness Level	Activities are expected to achieve TRL 7-9 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.

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 the different space programme components Galileo, including its differentiators (OSNMA Open Service Navigation Message Authentication, HAS High Accuracy Service, RLS Return Link Service, CAS Commercial Authentication Service 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[405];

- 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 the importance of digital technologies and infrastructures as vital societal assets. European 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 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 timestamping of transactions (finance), as well as commodities trading and risk assessment. With a view to the energy, communication and banking applications,

405 EU Mission: Climate-Neutral and Smart Cities | European Commission (europa.eu).

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) or Post Quantum Cryptography (PQC) 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.).

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

HORIZON-EUSPA-2023-SPACE-01-42: EGNSS - Closing the gaps in mature, regulated and long lead markets

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.50 and 2.50 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 8.00 million.

Type of Action	Innovation Actions
Eligibility conditions	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).
Technology Readiness Level	Activities are expected to achieve TRL 7-9 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.

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, harbour areas and other maritime areas** (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 implementation 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 4 "Digital, Industry and Space", Cluster 5

"Climate, Energy and Mobility", Cluster 6 "Food, Bioeconomy, Natural Resources, Agriculture and Environment" and the EU Mission on Climate neutral and smart cities.

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

HORIZON-EUSPA-2023-SPACE-01-43: Copernicus-based applications for businesses and policy-making

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.00 and 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 7.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	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).
Technology Readiness Level	Activities are expected to achieve TRL2 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Procedure	To ensure a balanced portfolio covering the areas described in the scope section, 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.

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, including those based on in situ/ground-based information and, where relevant, other 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.

5) 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).

6) 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.

A proposal should address only one area, which should be clearly indicated.

Projects are expected to engage with the entrusted entities in the frame of the Copernicus Core Services for the development and validation of relevant services using heterogeneous data sources.

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.

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

HORIZON-EUSPA-2023-SPACE-01-44: The Galileo PRS service for governmental authorised use cases

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.00 and 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 9.00 million.
Type of Action	Innovation Actions
Eligibility conditions	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: • Member States that have designated a Competent PRS authority (CPA) in accordance with Decision No 1104/2011, and • third countries that have concluded (i) a specific agreement on participation in Galileo and EGNOS, in accordance with Article 7 of Regulation 2021/696, and (ii) have become PRS participants, on the basis of international agreements concluded with the Union, in accordance with Article 3 of Decision 1104/2011, and (iii) have designated a Competent PRS authority (CPA), in accordance with Decision 1104/2011. The proposed activities shall be carried out in full compliance with the applicable PRS regulatory framework. 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).
Technology Readiness Level	Activities are expected to achieve TRL 5-7 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Legal and financial set-up of the Grant Agreements	Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy

	Community (2021-2025). [406].

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

- Develop the use cases for authorised civilian users based on the added value of PRS service;
- Develop the PRS applications targeting civilian users by leveraging PRS technology;
- Build on top of previous exploratory activities and lessons learnt on the development of PRS items by stimulating the corresponding downstream PRS uptake;
- Foster a European-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;
- Emergency and disaster recovery.

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. European cross-border cooperation is requested.

Proposals submitted should ensure gathering at least 3 potential European user communities (at least from 3 different PRS Participants).

[406] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

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.

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

HORIZON-EUSPA-2023-SPACE-01-45: Joint Test Activities for Galileo PRS service

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.50 and 3.00 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 3.00 million.
Type of Action	Innovation Actions
Eligibility conditions	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: • Member States that have designated a Competent PRS authority (CPA) in accordance with Decision No 1104/2011, and • third countries that have concluded (i) a specific agreement on participation in Galileo and EGNOS, in accordance with Article 7 of Regulation 2021/696, and (ii) have become PRS participants, on the basis of international agreements concluded with the Union, in accordance with Article 3 of Decision 1104/2011, and (iii) have designated a Competent PRS authority (CPA), in accordance with Decision 1104/2011. The proposed activities shall be carried out in full compliance with the

	applicable PRS regulatory framework. 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).
Technology Readiness Level	Activities are expected to achieve TRL 6-7 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Legal and financial set-up of the Grant Agreements	Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [407].

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

- 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 European 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).

[407] This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

EUSPA 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.

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

HORIZON-EUSPA-2023-SPACE-01-46: Designing space-based downstream applications with international partners

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 0.80 and 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 6.00 million.
Type of Action	Research and Innovation Actions
Eligibility conditions	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 member states [408], India and Brazil. Discussions towards similar cooperation have been started with other countries and regions (including United Nations Agencies and Asia-Pacific countries). Those countries and regions would also be eligible for Union funding if the corresponding administrative cooperation agreements have been signed

[408] *"African Union member states" includes countries whose membership has been temporarily suspended.*

	by the time of the Horizon Europe grant signature. 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).
Technology Readiness Level	Activities are expected to achieve TRL 3-4 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.
Legal and financial set-up of the Grant Agreements	Eligible costs will take the form of a lump sum as defined in the Decision of 7 July 2021 authorising the use of lump sum contributions under the Horizon Europe Programme – the Framework Programme for Research and Innovation (2021-2027) – and in actions under the Research and Training Programme of the European Atomic Energy Community (2021-2025). [409].

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.

409 This decision is available on the Funding and Tenders Portal, in the reference documents section for Horizon Europe, under 'Simplified costs decisions' or through this link: https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/guidance/ls-decision_he_en.pdf

- 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' and associated countries' 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.

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

Innovative space capabilities: SSA, GOVSATCOM, Quantum

Proposals are invited against the following topic(s):

HORIZON-EUSPA-2023-SPACE-01-61: EU GOVSATCOM for a safer and more secure EU

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3.00 and 4.00 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 10.00 million.
Type of Action	Innovation Actions
Eligibility conditions	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). The following additional eligibility criterion applies: at least one public entity must participate as member of the consortium selected for funding as the public entities are the main users of GOVSATCOM (according to Art. 65 of the EU Space Regulation 2021/696). In order to achieve the expected outcomes, and safeguard the Union's strategic assets, interests, autonomy, or security, and and more particularly, for the reasons of EU strategic autonomy in space and the security and integrity of EU space assets, and in order to guarantee the protection of the strategic interests of the Union and its Member States, participation is limited to legal entities established in Member States and to third countries that have concluded a specific agreement on participation in GOVSATCOM, in accordance with Article 7 of Regulation 2021/696 and have designated a Competent GOVSATCOM Authority in accordance with Article 68 of Regulation 2021/696. 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 approved by the 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.
Technology Readiness Level	Activities are expected to achieve TRL 7-9 by the end of the project – The reference TRL definition is the ISO 16290:2013 applicable to the space sector.

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 and a final demonstration 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;
- Elaborate the definition of the validation strategy and a user engagement plan and gather users' feedback to feed the development and the evolution of the EU GOVSATCOM services and prepare for their users' uptake;

The GOVSATCOM use cases and associated operational terminals could leverage, when possible, on previous developments. 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 development of terminals interoperable among different SATCOM systems should be also encouraged.

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 and ensure engagement of relevant user communities. 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).

In particular, we encourage the submission of proposals focussing in the following areas:

- Response to natural and man-made disasters or Emergency services/ambulances (for Civil Protection);
- Rail traffic management, to improve the limitations linked to geographical barriers (e.g. tunnels, valleys, cities);
- Telemedicine for humanitarian aid.

The projects should improve one or more operational terminals to demonstrate the access of the respective users to an early EU GOVSATCOM service, showcasing the benefits and fostering users' uptake. The applicants 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 projects 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 the frame of the demonstration activities, it is expected to involve industrial stakeholders, the equipment should therefore support demonstration activities of the early developed services.

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

Budget[410]

	Budget line(s)	2023 Budget(EUR million)	2024 Budget(EUR million)
Calls			
HORIZON-CL4-2023-TWIN-TRANSITION-01		334.27	
	from 01.020240	*181.22*	
	from 01.020240 - NGEU	*153.05*	
HORIZON-CL4-2023-TWIN-TRANSITION-01-TWO-STAGE		12.00	
	from 01.020240	*12.00*	
HORIZON-CL4-2024-TWIN-TRANSITION-01			251.00
	from 01.020240		*251.00*
HORIZON-CL4-2024-TWIN-TRANSITION-01-TWO-STAGE			37.00
	from 01.020240		*37.00*
HORIZON-CL4-2023-RESILIENCE-01-TWO-STAGE		124.00	
	from 01.020240	*124.00*	
HORIZON-CL4-2023-RESILIENCE-01		213.00	
	from 01.020240	*159.05*	
	from 01.020240 - NGEU	*53.95*	

410 The budget figures given in this table are rounded to two decimal places.
The budget amounts are subject to the availability of the appropriations provided for in the general budget of the Union for years 2023 and 2024.

HORIZON-CL4-2024-RESILIENCE-01-TWO-STAGE			62.00
	from 01.020240		*62.00*
HORIZON-CL4-2024-RESILIENCE-01			160.20
	from 01.020240		*160.20*
HORIZON-CL4-2023-DATA-01		76.00	
	from 01.020240	*48.00*	
	from 01.020240 - NGEU	*28.00*	
HORIZON-CL4-2024-DATA-01			85.00
	from 01.020240		*85.00*
HORIZON-CL4-2023-DIGITAL-EMERGING-01		108.00	
	from 01.020240	*75.10*	
	from 01.020240 - NGEU	*32.90*	
HORIZON-CL4-2023-DIGITAL-EMERGING-01-CNECT		129.00	
	from 01.020240	*96.10*	
	from 01.020240 - NGEU	*32.90*	
HORIZON-CL4-2024-DIGITAL-EMERGING-01			136.50
	from 01.020240		*136.50*
HORIZON-CL4-2024-DIGITAL-EMERGING-01-CNECT			88.00
	from		*88.00*

	01.020240		
HORIZON-CL4-2023-SPACE-01		137.50	
	from 01.020240	*82.50*	
	from 01.020240 - NGEU	*55.00*	
HORIZON-CL4-2024-SPACE-01			46.30
	from 01.020240		*46.30*
HORIZON-CL4-2023-HUMAN-01		55.00	
	from 01.020240	*52.40*	
	from 01.020240 - NGEU	*2.60*	
HORIZON-CL4-2023-HUMAN-01-CNECT		201.50	
	from 01.020240	*131.20*	
	from 01.020240 - NGEU	*70.30*	
HORIZON-CL4-2024-HUMAN-01			61.00
	from 01.020240		*61.00*
Contribution from this part to call HORIZON-MISS-2023-CIT-02 under Part 12 of the work programme		0.95	
	from 01.020240	*0.95*	
Contribution from this part to call HORIZON-MISS-2023-CIT-01 under Part 12 of the work programme		7.63	
	from 01.020240	*7.63*	
Contribution from this part to call		7.54	

HORIZON-MISS-2023-CLIMA-CITIES-01 under Part 12 of the work programme	*from 01.020240*	*7.54*	
Contribution from this part to call HORIZON-MISS-2023-OCEAN-SOIL-01 under Part 12 of the work programme		2.72	
	from 01.020240	*2.72*	
Contribution from this part to call HORIZON-MISS-2023-OCEAN-01 under Part 12 of the work programme		17.47	
	from 01.020240	*17.47*	
Contribution from this part to call HORIZON-MISS-2023-CLIMA-OCEAN-SOIL-01 under Part 12 of the work programme		2.63	
	from 01.020240	*2.63*	
Contribution from this part to call HORIZON-MISS-2023-CLIMA-01 under Part 12 of the work programme		15.42	
	from 01.020240	*15.42*	
Contribution from this part to call HORIZON-CL5-2023-D2-01 under Part 8 of the work programme		7.00	
	from 01.020240	*7.00*	
Contribution from this part to call HORIZON-MISS-2023-SOIL-01 under Part 12 of the work programme		17.78	
	from 01.020240	*17.78*	
Contribution from this part to call HORIZON-WIDERA-2024-ERA-01 under Part 11 of the work programme			1.00
	from 01.020240		*1.00*
Contribution from this part to call HORIZON-MISS-2023-CANCER-01 under Part 12 of the work programme		3.40	
	from 01.020240	*3.40*	
Other actions			
Grant to identified beneficiary according to Financial Regulation Article 195(e)		2.60	1.60
	from 01.020240	*2.60*	*1.60*

Specific grant agreement			25.00
	from 01.020240		*25.00*
Grant awarded without a call for proposals according to Financial Regulation Article 195			56.50
	from 01.020240		*56.50*
Public procurement		8.66	7.10
	from 01.020240	*8.66*	*7.10*
Expert contract action		3.15	3.65
	from 01.020240	*3.15*	*3.65*
Provision of technical/scientific services by the Joint Research Centre		2.50	
	from 01.020240	*2.50*	
Subscription action		0.05	0.05
	from 01.020240	*0.05*	*0.05*
Indirectly managed action		177.10	96.10
	from 01.020240	*152.10*	*96.10*
	from 01.020240 - NGEU	*25.00*	
Contribution from this part to Specific grant agreement under Part 12 of the work programme		8.09	
	from 01.020240	*8.09*	
Contribution from this part to Expert contract action under Part 12 of the work programme		0.15	
	from 01.020240	*0.15*	
Contribution from this part to Indirectly		1.89	

managed action under Part 12 of the work programme	*from 01.020240*	*1.89*	
Estimated total budget		1677.02	1118.00