1st Draft Work Programme 2025

Cluster 4 – Digital, Industry and Space

DIGITAL PARTS

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AI-GenAI / Data / Robotics

Fostering Innovative and Compliant Data Ecosystems (IA) (AI, Data and Robotics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 7 and 9 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 45 million.
Type of Action	Innovation Actions
Technology Readiness Level	Activities are expected to start at TRL 5-7 and achieve TRL 7-8 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

- Easing the compliance process of businesses and professionals with the relevant EU legislation, in particular reporting obligations, and alleviating administrative burdens for businesses, and professionals
- Development and integration of advanced technology for data collection, data sharing and data analytics for simplifying and automating compliance.
- Generating, managing, and leveraging synthetic data to improve fitness for purpose. These initiatives aim to address limitations of real-world data, enhance data quality, diversity, and representativeness, while mitigating bias
- Ensuring necessary user training and support for rolling out and scaling up "compliance by design" and the FAIR[1] principles in the constantly evolving regulatory landscape

Scope:

As the European Union (EU) legislation continues to expand, both in the digital (GDPR, Open Data Directive (ODD), Data Governance Act, AI Act, Data Act) and non-digital realm (green deal, due diligence, healthcare), organizations face increasing challenges in maintaining compliance. Also, the complexity and volume of reporting obligations are growing, posing difficulties for both regulatory bodies to enforce laws and for entities trying

to comply. These challenges underscore the need for innovative solutions to streamline compliance processes and enhance competitiveness within the EU.

Another current challenge are limitations of real-world data such as issues with availability, confidentiality, and bias. Synthetic data is becoming increasingly vital in addressing these problems. By generating and utilizing synthetic data, actions within this framework aim to enhance data quality, diversity, and representativeness, making it a crucial tool for AI-powered innovation and regulatory compliance.

Where relevant, the actions should address **interoperability and standardization**, and/or liaise with other actions working on interoperability or standardisation, in view of facilitating effective data sharing across platforms and sectors, while ensuring an adequate level of security and protection.

Actions should provide necessary comprehensive **user training and support**, ensuring adaptability and scalability to accommodate evolving regulations and diverse organizational needs and to raise awareness and improve understanding of relevant compliance issues.

The proposal must clearly state (in the abstract and in the introduction) which of the following three areas it addresses. A proposal can address more than one area, but it should indicate one of them as the main focus of the proposal, and it will be evaluated accordingly under that area.

- Area 1: Actions to develop advanced compliance technology integrating AI, cybersecurity, language technologies, and privacy preservation. This framework could include the creation of NLP-driven semantic analysis tools for deciphering complex legal texts and translating them into clear compliance tasks, or machine learning algorithms trained on historical data to predict and mitigate potential compliance violations. With the capability to detect changes in EU legislation, these advanced AI systems and analytics tools will provide deep insights into compliance performance, risk management, and help forecast upcoming regulatory trends to strategically prepare for future requirements.

- Area 2: Actions to ensure auto-compliance of data transactions and data spaces with applicable regulation (e.g. data and sectoral legislation). Actions in this area should anticipate compliance tasks within the context of Common European Data Spaces and coordinate with them as necessary. Actions in this area are required to analyse and take into account the specific architecture, exchange mechanisms, tools, data types and user needs of the actual data spaces, liaising with and building on other actions working in this area, in particular the Data Spaces Support Centre.

- Area 3: Actions to generate, manage and leverage **sy**nthetic data in order to improve data quality, availability, representativity, fitness for purpose and compliance. The actions should in particular address the inherent shortcomings of real world data that would necessitate synthetic data (e.g. data availability, confidentiality, privacy protection, enhancing quality, diversity, representativeness, bias). Additionally, actions may target generating synthetic data for sparse or unusual domains, integrating synthetic and real data effectively, or advancing technological capabilities in generative models and simulation-based approaches to drive synthetic data generation forward and/or addressing or modelling rare events and complex systems. All actions under this Area are required to address the evaluation, validation and benchmarking of synthetic data to ensure fitness for purpose and safe use of synthetic data.

Proposals will be selected so that each area is addressed at least by one selected proposal.

<u>Links with topics in other WPs:</u>

- All Digital Europe programme topics implementing Common European Data Spaces, especially the Data Spaces Support Centre (DSSC).

- HORIZON-CL4-2023-DATA-01-01 AI-driven data operations and compliance technologies (IA).

- HORIZON-CL4-2021-DATA-01-01 Technologies and solutions for compliance, privacy preservation, green and responsible data operations (RIA).

Empowering AI/GenAI along the Cognitive Computing continuum (RIA) (AI/Data/ Robotics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 6 and 8 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 30 million
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 3 and achieve TRL 6-7 by the end of the project – see General Annex B.
Article 22.5	**NO**
Lump-sums	**YES**

<u>Expected outcome:</u>

Projects are expected to contribute to the following outcomes:

- **Novel AI-enabled Cloud and Edge management solutions** tailored for the processing needs of AI workloads across the cognitive cloud-edge-IoT continuum.

- Strategic industrial cooperation across the Cloud-Edge-IoT cognitive computing continuum to support future **hyper-distributed AI applications.**

- Seamless and trustworthy integration across diverse computing and data environments spanning from core cloud (including HPC) to edge to IoT.

- Enhanced openness and open strategic autonomy in the evolving data and AI-economies across the computing continuum **validated through key business/societal sectors**.

- Better international collaboration with trusted partner regions, guaranteeing a minimum level of interoperability and portability thereby facilitating European access to foreign markets.

Scope:

The Cloud to Edge Continuum needs to provide seamless and trustworthy integration of diverse computing and data environments spanning from core cloud to edge to IoT and support the enormous data, processing needs, and new resource types brought by next generation AI technologies.

Different types of AI processes pose different requirements that compute infrastructures need to meet to execute them. The state-of-the-art in generative AI and large language models is heavily reliant on high-performance processing and very large AI models. Cutting-edge hardware accelerators that power these processing systems are scarce on the market and only available in highly specialised, high-performance infrastructures in certain cloud and HPC environments at considerable costs. At the same time, the requirement to gather, process, and transmit massive amounts of data to the central data processing environment remains a barrier for many AI applications. All these factors urge the emergence of efficient tools and mechanisms **to empower the distribution of AI training and inference processes throughout the computing continuum.**

Empowering the next generation AI technologies with on-demand, agile and situation-aware infrastructure that brings data- and computing power to where and when it is needed will let end-users exploit Artificial Intelligence across the computing continuum without compromising on security and trust and optimising their energy use. These **challenges** span various aspects of the continuum, including **data orchestration, AI integration, decentralised intelligent management, decentralized and global optimization, energy and resource heterogeneity support, data management, security/privacy, and synergies with 5G/6G.** Addressing these challenges is crucial for realizing the vision of a cognitive cloud-to-edge continuum as a key enabler for any emerging trends such as AI/GenAI.

The Cognitive Computing Continuum could eventually be extended to i**nclude other computational resources**, such as **HPC**, and provide abstraction layers to maximize the benefits of available hardware.

Addressing all the above complexities calls for innovative research to overcome these challenges. **The aim is to develop generic and AI-enabled cloud-edge technologies encompassing the whole computing continuum to empower the development of AI/ GenAI technologies and applications.** The proposals should demonstrate the generic applicability of the proposed technological solutions across various application domains.

The following (one or more) research areas need to be addressed:

- **Development of novel mechanisms for the efficient development, deployment, and operation of AI workflows** across heterogeneous and distributed infrastructures along the Edge to Cloud to HPC continuum that optimise training times, model accuracy and data management while factoring in performance metrics such as memory usage, energy efficiency, application processing and data transfer latency, and network overheads. These should factor in virtualisation and orchestration techniques that seamlessly integrate heterogeneous processor architectures.

- **Decentralised and federated computing continuum tools and mechanisms to enable distributed AI architectures.** These include scheduling, orchestration, and placement mechanisms that leverage the wide range of Edge computing environments available in the compute continuum, including on-device edge. The focus is on enhancing AI process execution through techniques such as model, data, hybrid parallelism and data compression, gossip, and federated training, or conditional computing.

- **Cloud and edge processing tools and techniques to reduce AI processing power usage and emissions across the cognitive computing continuum**, relying on hardware efficiency and energy optimisation techniques, such as hardware and software approximation.

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

Links with topics in other WPs:

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.

All proposals are expected to share communicable results with the European R&D community, through the AI-on-demand platform, 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.

International cooperation

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

Gender Dimension

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

GenAI4EU central Hub (CSA) (AI/Data/Robotics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 3 million.
Type of Action	Coordination and Support Action
Article 22.5	**NO**

Expected outcome:

- Creation of the GenAI4EU HUB: developing a strong and visible GenAI4EU community, supporting the uptake of European GenAI solutions across strategic application sectors and the HE Clusters, through collaboration and knowledge exchange.

- This CSA will also support the European Commission's AI Office in its function to promote an innovative ecosystem of trustworthy AI, to reap the societal and economic benefits.

Scope:

This horizontal Coordination and Support Action for GenAI4EU will develop a strong and visible European GenAI ecosystem of developers and users, aiming to strengthen the coordination, impact and visibility of the GenAI4EU initiative[1] across diverse sectors. This CSA should be prepared, managed and coordinated by the key stakeholders in this field.

Serving as a hub for collaboration, this project seeks to streamline efforts in developing high-impact GenAI-based applications while fostering among various stakeholders.

It will support all the Horizon Europe Pillar 2 clusters, in addressing their policy needs through the implementation of the GenAI4EU initiative.

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[1]
Communication_on_boosting_startups_and_innovation_in_trustworthy_AI_3V9PtH703Rb5OjDHYc64ptlpZs_1 01621 (5).pdf

It will foster the uptake in all strategic application sectors, namely the ones addressed in the GenAI4EU initiative, including the 14 industrial ecosystems, in stimulating collaborations between the European developers and users.

It should be driven by the most advanced stakeholders in the field, in particular those active in developing local GenAI communities, tech transfer, attracting investment, and making the European GenAI stakeholders visible.

The selected proposal will establish connections between different initiatives such as the AI Factories, GenAI4EU Skills, and relevant activities implemented under the EU's Digital Europe Programme, as well as national activities. The selected proposal is also expected to build on or seek collaboration with existing projects and develop synergies with other relevant European, national or regional initiatives, funding programmes and platforms.

In addition, the selected proposal will conduct a comprehensive landscape analysis of generative AI initiatives. This includes an inventory of use cases, capabilities, evaluation tools and methods to assess generative AI models. By identifying prioritized sectors and sharing best practices, the project aims to bridge existing gaps and foster innovation uptake.

Furthermore, the selected proposal will assess potential areas that require further research, including coordination with national initiatives, to ensure comprehensive coverage and collaboration. It will actively engage in networking and community animation to foster knowledge exchange and collaboration among stakeholders.

This topic implements the co-programmed European Partnership on AI, data and robotics (ADRA) and all proposals are expected to allocate tasks to cohesion activities with ADRA and the funded actions related to this partnership under the call CSA HORIZON-CL4-2021-HUMAN-01-02. This initiative will capitalise on these existing initiatives, complement them and ensure integration within the existing ecosystem developed by ADRA.

Assessment methodologies for General Purpose AI capabilities and risks (RIA) (AI/Data/ Robotics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 3 and 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 7 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

- New assessment and validations methodologies developed allowing to evaluate General Purpose AI (GPAI) models, including multimodal systems, and systems' capabilities and risks.

- Use of the research outcomes by GPAI providers, policymakers, and other relevant stakeholders to create benchmarks for evaluating GPAI models and systems' capabilities and risks.

- Support to the AI Office in its function to conduct evaluations of general-purpose AI models with a view to enforce the rules for general-purpose AI models.

Scope:

The rapid advancement of artificial intelligence (AI) has led to the development of increasingly sophisticated general-purpose AI (GPAI) models and systems. These models, such as large language models and multimodal AI systems, demonstrate remarkable capabilities across a wide range of tasks. However, assessing the capabilities of these models remains a significant challenge. Traditional evaluation methods often fail to capture the full spectrum of abilities exhibited by GPAI models and systems. Therefore, there is a pressing need for the development of *new assessment frameworks, methodologies and tools* that can comprehensively evaluate these models in terms of their trustworthy and ethical behaviour and operation, ensuring their reliability, fairness, and alignment with human values.

This topic aims to develop robust assessment tools, techniques, and benchmarks specifically designed to rigorously evaluate GPAI models and systems, including multimodal systems. Proposals should cover one or more of the following research areas:

- Innovative methods for proactively identifying and forecasting emergent capabilities in GPAI models and systems. This encompasses the identification of capabilities with both beneficial and potentially detrimental uses.
- Assessment of GPAI capabilities with a significant economic impact or potential for misuse. This includes assessing capabilities that drive beneficial innovation and societal good, as well as evaluating potential risks in areas such as chemical, biological, radiological, and nuclear (CBRN) hazards or cybersecurity threats.
- Developing assessment techniques that illuminate the underlying mechanisms of emergent capabilities in AI systems, emphasising interpretability and explainability.

Projects should generate example benchmark tests to examine trained AI models, systematically uncovering latent capabilities. These benchmarks will be made available to GPAI providers, policymakers, and other relevant stakeholders to implement robust evaluation tools.

This call strongly encourages the formation of interdisciplinary teams combining the necessary technical expertise. Such a collaborative approach will ensure that assessments accurately capture real-world capabilities and risks, and that the developed frameworks, methodologies and tools are responsive to the concerns of all relevant stakeholders.

Proposals must adhere to Horizon Europe's guidelines regarding Open Science practices. Open access to research outputs should be provided unless there is a legitimate reason or constraint; in such cases, the proposal should detail how GPAI providers, policymakers, and other stakeholders will access the research outcomes.

All proposals are expected to incorporate mechanisms for assessing and demonstrating progress, including qualitative and quantitative KPIs, benchmarking, and progress

monitoring. This should include participation in international evaluation contests and the presentation of illustrative application use-cases that demonstrate concrete potential added value. Communicable results should be shared with the European R&D community through the AI-on-demand platform, and if necessary, other relevant digital resource platforms to bolster the European AI, Data, and Robotics ecosystem by disseminating results and best practices.

This topic implements the co-programmed European Partnership on AI, data and robotics (ADRA), and all proposals are expected to allocate tasks for cohesion activities with ADRA.

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

Soft Robotics for Advanced physical capabilities (IA) (AI/Data/Robotics Partnership)

Specific conditions	
Expected EU contribution per project	The Commission estimates that an EU contribution of between 10 million and 20 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 20 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL [T2-3] and achieve TRL [T4-5] by the end of the project – see General Annex B.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.
Article 22.5	**NO**
Lump-sums	**NO**

Expected outcome:

Increased exploitation of novel materials, design methods, and control techniques for soft robotics, enabling the creation of inherently safe and versatile robotic systems with applications in various industries, including healthcare, manufacturing, and transportation.

Scope:

Soft robotics is an important avenue to advance robotics physical capabilities. Such approach offers intrinsic safety in the physical world while surpassing the limitations of rigid robotic systems. Advancing robotic performance relies on novel design methods and physical architectures as well as the use of novel materials. In parallel, advances in robotic controllers are necessary to guide soft robotic structures in order to reach the required level of performance and precision.

The proposals should include demonstrators that clearly show the advantage of soft robotics in the context of some chosen application scenarios. The objective is to develop and

disseminate general purpose tools and systems, therefore the results should not be limited to the demonstration scenarios selected in the proposals to demonstrate the technological progress.

All proposals are expected to incorporate mechanisms for assessing and demonstrating progress, including qualitative and quantitative KPIs, benchmarking, and progress monitoring. This should include participation in international evaluation contests and the presentation of illustrative application use-cases that demonstrate concrete potential added value. Communicable results should be shared with the European R&D community through the AI-on-demand platform, and if necessary, other relevant digital resource platforms to bolster the European AI, Data, and Robotics ecosystem by disseminating results and best practices.

This topic implements the co-programmed European Partnership on AI, data and robotics (ADRA), and all proposals are expected to allocate tasks for cohesion activities with ADRA.

GenAI4EU in Robotics and industrial automation (RIA) (AI/Data/Robotics & Made in Europe Partnerships)

Expected EU contribution per project	The Commission estimates that an EU contribution between 20 and 45 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 85 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL [T2-3] and achieve TRL [T4-6] by the end of the project – see General Annex B.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G.
Article 22.5	**TBD**
Lump-sums	**NO**

Proposals are expected to address at least one of the expected outcomes, either type A) or B). The type must be clearly identified within the proposal.

The budget will be split in a balanced way between Type A and Type B defined below. Proposals should clearly identify the area they are addressing.

Expected outcome:

Type A) GenAI4Robotics for industrial automation:

- Development of advanced foundation models for robotics, fostering increased autonomy and generalization capabilities, thus enabling robots to dynamically learn and comprehend their physical surroundings in real-time, ensuring adaptability and reliability across diverse and complex scenarios.

- Validation of the model through fine-tuning and downstream application to address industrial automation use-cases.

Type B) Trustworthy and robust Generative AI for improved manufacturing:

- Increased productivity by high quality, flexible and resource-efficient industrial automation, both on the shop floor and in engineering/business processes;

- Significantly improved facilitation of product and process certification and compliance assessment, as well as reliability, efficiency and sustainability of manufacturing processes, supporting easier high-mix production and manufacturing of products based on sustainable and advanced technologies; and

- Significantly facilitated installation, commissioning and decommissioning of production facilities, through tools that enable faster industrialisation of factory automation well beyond the pilot phase, while reducing the need for manual on-site interventions.

Scope

Type A) While it is widely acknowledged that current use of Generative AI has the potential to impact certain tasks in robotics such as improving user interaction or providing explanations about why a robot system made a particular decision, these are, in general, not within the critical operating flow of a robot. To reach next level of autonomy, Generative AI must also enable planning, decision making and control fitting the physical constraints imposed both by the environment and by the physical construction of the robot.

This represents a significant advancement in robotics, requiring the development of AI models that can adeptly navigate the complexities of the physical world while ensuring safety. Generative AI is expecting to bring such a step-change in robots adaptability, versatility and robustness, enabling them to efficiently achieve real world tasks with higher level of autonomy.

In the context of advancing robotics capabilities, the use of Generative AI stands as a transformative force, amplifying robots' learning, interaction, and operational abilities. By enabling robots to learn from experiences, simulate diverse environments for training, and enhance human-robot interaction, it drives adaptability and efficiency. Additionally, Generative AI facilitates the augmentation of robot planning capabilities, empowering them to predict outcomes of various actions, thereby elevating their autonomy and decision-making prowess.

Training current generative AI models, in particular Large Language models, requires high volumes of data to achieve effective levels of performance. The vast amount of data required present a significant challenge when it comes to robotics. Further research is necessary to find the appropriate balance between the quality, adequacy, and volume of data with regards to the

performance of the AI model. The training data should come from the real world or from physical aware simulations of the real world.

Proposals should detail strategies to leverage cutting-edge Generative AI techniques to enhance the adaptability and reliability of these models across complex and dynamic scenarios. The goal is to train and fine-tune generative AI models that meet the necessary standards for ensuring the safe operation of robotics hardware. These models should empower robots to autonomously plan and execute actions while maintaining high levels of performance and generalization capabilities.

Research activities should explore the training methodologies for these foundation models, emphasizing their ability to process multimodal data and derive actionable insights to inform robotic decision-making processes.

The proposals are also expected to include the validation of the trained models through applications. Proposals should detail methodologies for conducting rigorous testing procedures, incorporating both simulation-based evaluations and physical experiments. These tests aim to evaluate the performance and scalability of developed foundation models.

The research will be driven by impactful scenarios defined by major manufacturing industry players, that should be well integrated in the consortium.They should be deeply involved in the proposed work in order to provide the use-case, the corresponding data and they wil play an important role to accompany the validation process. They will define a number of representative real-world use-cases with gradually increased level of complexity to drive the technology development. They will provide existing relevant data and collect further data necessary to train and fine-tune the models, but also to validate the solutions. Given the sensitivity of sharing industrial data, manufacturers present in the consortium have to define upfront mechanisms to collectively provide a sufficiently large dataset for training the models, ensuring sufficient quality and quantity of data needed to train the models. If necessary, they will have to put in place mechanisms to acquire data from sources outside the consortium.

The emphasis lies in creating and disseminating general-purpose models and tools rather than being limited to narrowly focused solutions. Projects should also build on or seek collaboration with existing projects and develop synergies with other relevant European (e.g. projects funded under HORIZON-CL4-2024-HUMAN-03-01: Advancing Large AI Models: Integration of New Data Modalities and Expansion of Capabilities), national or regional initiatives, funding programmes and platforms.

Type B)

The objective is to enhance productivity and provide a competitive advantage to EU industry in the transition towards more sustainable, zero-carbon production, addressing the

uncertainties and tensions on supply chains and the lack of highly-skilled workers. A new generation of digital technologies will integrate generative Artificial Intelligence, robotics, and advanced human interfaces in industry-grade applications with a high degree of autonomy. This will enable the development, production, and operation of complex and advanced high-tech products at lower cost while improving sustainability and flexibility, ultimately becoming a powerful tool for accelerating innovation in both processes and products.

The manufacturing sector should strongly benefit from increased levels of automation made possible by breakthroughs provided by AI, in particular by the family of technologies know as Generative AI, including (e.g.) AI foundation models, large language models, transformers, multimodal generative AI. A priority of this topic is the development of Generative AI solutions dedicated to the manufacturing sector and making use of manufacturing data available in production lines.

Proposals should address at least one of the following use-cases:

1)   Robustness and trustworthiness of digital technologies and data management at industry-grade quality, to raise the automation levels on production sites and across industry and supply chains;

2)   Enhance product and process qualification/certification and compliance assessment through higher levels of automation, digitalisation and data management, taking into account related requirements;

1) Automation of manufacturing processes to achieve higher reliability, efficiency and sustainability;

4)   Automated tools for fast and large-scale deployment and reconfiguration of production assets and for rapid innovation cycles.

Proposals should accomplish these objectives exploiting the most suitable approach(es) among the ones described below:

- The integration of generative Artificial Intelligence applications exhibiting trained model(s) specifically designed for manufacturing, providing measurable advantages in one of more of these key areas: manufacturing cost, increased productivity, quality, flexibility, resilience, sustainability, circularity, time to market and usability. Applications can target factory-floor operations and/or management of data, knowledge and documentation associated to products and production (for use-case 1 or 2);

- Development and integration of digital production systems capable of significantly increasing productivity and managing high-mix production with close to zero time needed for re-purposing and capability to manage different mixes of materials and components (for use-case 3);

- Development of deployment tools to automate the management of production lines, namely through automatic configuration, integration with legacy systems, placement of data translators and connectors, and deployment of machines and sensors on the shop floor (for use-case 4).

Proposals should indicate which approach they are targeting. Proposals may combine several approaches above, indicating which is the main approach, provided there is added value in such a combined approach; arbitrary combinations without integration are excluded.

The use of generative Artificial Intelligence techniques is encouraged for all the approaches, even when it is not the primary target of the proposal. The applicants will specifically describe how they will secure the acquisition of quality manufacturing data from real-world industrial use cases of industry partners or companies outside the consortium in the context of the data volume necessary to train and finetune the models used in the proposal.

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, focusing on open specifications and standards, enabling effective cross-domain data communities, and new data-driven markets.

For both Type A and Type B of proposals the primary source of computing resources for pretraining should be sought from external high-performance computing facilities such as EuroHPC or National centres. The proposal should describe convincingly the strategy to access these computing resources.

Advancing General Purpose AI through Enhanced Learning Strategies (RIA) (AI/Data/ Robotics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 30 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 2-3 and achieve at least TRL 45 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

- Development of General Purpose AI (GPAI) models and architectures demonstrating enhanced capabilities, such as formal reasoning, mathematical problem-solving, long-term planning, and seamless adaptation to dynamic environments.

- Innovative learning approaches combining self-supervised learning with hybrid learning, active learning, reinforcement learning, relational learning or continual learning and evolutionary learning.

- Theoretical insights to advance the understanding of synergies between self-supervised and complementary learning paradigms in GPAI model development.

Scope:

Current large-scale AI models have demonstrated remarkable capabilities that have transformed numerous fields. They excel at tasks like natural language processing, image generation, and playing complex games. However, despite these successes, current models often struggle in several key areas. They lack the adaptability to seamlessly adjust to changing conditions in real-world environments. Additionally, their reasoning abilities remain limited, when facing complex tasks that require logical deduction, mathematical problem-solving, or

multi-step planning. These limitations underscore the need for advancements in General Purpose AI (GPAI) that go beyond pattern recognition and towards robust, adaptive systems capable of a wider range of intelligent behaviours.

To push the boundaries of current AI technology, this topic seeks the development of groundbreaking GPAI models that combine self-supervised learning with complementary learning strategies. These strategies include hybrid learning, which integrates symbolic reasoning and knowledge representation; active learning, which allows models to actively seek information to improve their performance; reinforcement learning, which enables models to learn through interaction with their environment; relational learning, which focuses on learning from relational data structures; continual learning, which allows models to continuously adapt and acquire new knowledge; and evolutionary learning, which draws inspiration from biological evolution to optimize model architectures and parameters. By leveraging these complementary approaches, the aim is to create GPAI models that exhibit enhanced capabilities, overcome existing limitations, and pave the way for a new generation of intelligent systems capable of tackling complex, real-world challenges.

This call prioritizes proposals that explore innovative approaches to developing GPAI models, focusing on at least one of the following key research areas:

- Hybrid Learning Architectures for Advanced Reasoning: Development of architectures integrating self-supervised learning with symbolic reasoning, knowledge representation, and neuro-symbolic methods to foster robust reasoning, complex planning, and problem-solving abilities within GPAI.

- Continual and Evolutionary Learning for Dynamic Environments: Research on paradigms enabling GPAI models to seamlessly adapt, learn from changing conditions, and retain knowledge essential for operation in dynamic, real-world environments.

- Reinforcement Learning Integration: Research on the fusion of self-supervised learning and reinforcement learning to overcome challenges like non-stationary data, algorithm sensitivity, and computational cost.

- Explainable AI and Trustworthy Decision-Making: Integration of robust XAI methodologies, exploring causal inference and counterfactual reasoning techniques to enhance transparency, accountability, and responsible use of GPAI models in alignment with European values and principles.

- Other Novel Paradigms: Research on the combination of self-supervised learning with other learning paradigms, such as active learning, relational learning, and embodied learning, to equip GPAI models with new advanced capabilities.

Proposed projects should aim for a balanced approach between theoretical advancements and practical applications, with a strong emphasis on the development of GPAI models that align with European values and principles.

The potential impact of this research extends beyond scientific advancements, as it has the potential to transform key European industries and sectors, including advanced robotics, personalized healthcare, precision agriculture, and sustainable energy solutions. Successful projects will contribute to the development of GPAI models that enhance productivity, improve decision-making, and foster innovation across a wide range of domains.

This call strongly encourages the formation of interdisciplinary teams combining the necessary technical expertise. Such a collaborative approach will ensure that assessments accurately capture real-world capabilities and risks, and that the developed tools are responsive to the concerns of all relevant stakeholders.

Proposals must adhere to Horizon Europe's guidelines regarding Open Science practices. Open access to research outputs should be provided unless there is a legitimate reason or constraint.

All proposals are expected to incorporate mechanisms for assessing and demonstrating progress, including qualitative and quantitative KPIs, benchmarking, and progress monitoring. This should include participation in international evaluation contests and the presentation of illustrative application use-cases that demonstrate concrete potential added value. Communicable results should be shared with the European R&D community through the AI-on-demand platform, and if necessary, other relevant digital resource platforms to bolster the European AI, Data, and Robotics ecosystem by disseminating results and best practices.

This topic implements the co-programmed European Partnership on AI, data and robotics (ADRA), and all proposals are expected to allocate tasks for cohesion activities with ADRA. Proposals 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.

Software Engineering for AI and Generative AI (RIA) (AI/Data/Robotics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 4 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 15 million.
Type of Action	Research and Innovation Action (ADRA partnership)
Technology Readiness Level	Activities are expected to start at TRL 4 and achieve TRL 7 by the end of the project – see General Annex B.
Article 22.5	**NO**
Lump-sums	**YES**

Expected outcome:

- Improved methods and tools to optimally develop and deliver AI algorithms and Generative AI.

Scope:

The latest developments in AI are demanding computation infrastructures designed to maximize the number of FLOPS. Europe has a window of opportunity to leverage open source and ensure that the European industry is at the cutting edge of these new processing infrastructures. The current methods and tools to develop and efficiently deliver AI pipelines and complex generative AI applications present several shortcomings.

Current identified challenges include the continuous management of data pipelines, novel testing methods (e.g. differential testing or improved performance testing), optimized deployment strategies (in terms of using energy efficient resources or the best performant), management of dependencies with a diverse set of types of hardware, as well as the maintenance of the effectiveness of AI applications, notably GenAI ones. Also, large language models and foundational models require the development and operation of complex system architectures that need to handle data processing at large scale, continuous training of models and inference. This presents novel challenges for developers that will need to be addressed with the development of new methods, mechanisms and tools covering the above, but not limited to.

The main objectives for the advancements of Software Engineering in this field are:

- Increasing the productivity of GenAI application developers, and operators, especially of foundational models and large language models-

- Simplifying and automating the development and operation of such applications.

- Facilitating AI progress and advancement beyond the state-of-the-art in the EU at a faster rate vis-à-vis the rest of the world.

Links with topics in other WPs:

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.

Challenge-Driven GenAI4EU Booster (RIA) (AI/Data/Robotics Partnership)

Specific conditions

Expected EU contribution per project The Commission estimates that an EU contribution of around EUR 15 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.

Indicative budget The total indicative budget for the topic is EUR 30 million

Type of Action Research and Innovation Action

Technology Readiness Level Activities are expected to start at TRL 3 and achieve TRL 6 by the end of the project – see General Annex B.

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

To ensure coverage of the topic expected outcomes, <u>one proposal per strategic sector</u> is expected to be selected, namely <u>one in aerospace and one in pharma/drug development.</u>

Article 22.5 **NO**

Lump-sums **NO**

Financial Support to Third Parties A minimum of 33% of the EU funding requested by the proposal should be allocated for the purpose of financial support to third parties.

Beneficiaries are expected to allocate at least 33% of the proposal's total budget as financial support in the form of grant for the highest-ranked participants following the first phase of the challenge

Expected Outcomes

- Significant technology progress and innovation through challenge-driven approach in the fields of aerospace and pharma/drug development.
- Increased competitivity and visibility of the Generative AI community in Europe, in demonstrating their capability to achieve challenging tasks within the aerospace and pharma/drug development sectors.
- Increased adoption of Generative AI in aerospace and pharma/drug development through tangible progress and achievement demonstrated via the process.

Scope

Generative AI promises to transform most industry sectors and public administration. This challenge-driven initiative aims to boost both Europe's developer community and the adoption of powerful Generative AI solutions in the strategic sectors of aerospace and pharma/drugs, key for their competitiveness.

The user industry leading the consortium should have a genuine interest in the projects results and therefore support the participants in the challenge to exploit the results, they should sponsor the winners at the various stages with different types of support (financial and others, such as partnerships) and provide the necessary support resources during the project (technical, business support, but most importantly provide the data necessary to fine-tune models and build powerful applications). The results will be pre-competitive but commitments on future exploitation are expected in the proposal.

Proposals will be driven by impactful use-cases where generative AI can make the difference: a number of industries will join forces to define challenging problems to solve, that will then drive the rest of the project. This will be followed by a staged approach with an increasing level of complexity, whereby third party participants, either companies or consortia of organisations, will compete to address the challenge.

For each proposal:

- At the end of the first stage, the 20 highest ranked participants to receive 250k€ funding to prepare for the next stage.

- At the end of the second phase, the four highest ranked participants will be invited to join the consortium and will receive 2M€ to prepare for the grand finale, where the best performing team will have the opportunity to conclude partnerships or contracts with the user industry/public administration leading the consortium.

The core consortium, including several major industry players will define a clear methodology to implement the various steps of the approach, define the calls specification, timelines, targets, KPIs, a solid evaluation methodology including evaluation criteria. They will also be in charge of implementing the evaluation methodology, and providing the necessary infrastructure/technical support for the participants. They will also be in charge of ensuring sponsorship and high visibility of the action.

Around 2M€ will be allocated for the core consortium to carry out these activities.

Visibility would be important; therefore dissemination and communication campaigns will be key. The project should also seek sponsorship, which would be key for the visibility and prestige of the challenge, and to attract the best European developers to compete.

Proposals should clearly define use-case and KPIs as well as the methodology to accompany the participants to the various steps during the project, and the assessment methodology during the various selection phases.

Connected Collaborative Computing Networks (3C networks)

Large-scale pilots for supply end-to-end infrastructures integrating device, network computing and communication capabilities for Telco Edge Cloud deployments, as a basis for Connected Collaborative Computing Networks (3C networks) (RIA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of up to EUR 80 million for a project 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 80 million.
Type of Action	Research Innovation Actions
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.
Legal and financial set-up of the Grant Agreements	The rules are described in General Annex G. Financial Support to Third Parties is allowed.
Article 22.5	**YES**
Lump-sums	**NO**
Financial Support to Third Parties	Beneficiaries may provide financial support to third parties up to 40 % of the proposal total budget. 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 support one or more of the following: • Extension of the pilots' infrastructure or technological capacities; • Addition of new technology or infrastructure providers; • Extension of the vertical domains covered in order to cover new or more advanced application domains. Participation of additional user groups.

Expected outcome:

- Strengthen European industrial ecosystems for the 3C Network, while enabling the path towards sustainability and competitiveness of key vertical sectors in the EU, to be supported in the work programme 2026-2027 of Horizon Europe by future large-scale pilot focusing on 3Cs demand in vertical industrial sectors such as "industrial virtual worlds" (automotive, aerospace, processing, manufacturing, agriculture), services (mobility, energy, smart communities) or others.

- Prototyping at scale end-to-end telco edge cloud integrated infrastructures and platforms, bringing together players from different segments of the connectivity value chain and beyond, such as operators, system integrators, network/cloud/edge suppliers, AI experts, IoT platform providers et al.

- Validating open orchestration platforms across the telco edge cloud continuum, to support unlocking the transformative value of AI for European businesses and driving business growth in multiple industries strategic for Europe.

- Integrating AI solutions for optimising the orchestration of the different resources to be managed by the pilot actions, such as bandwidth, spectrum, computing, hardware, other user requirements.

- Testing, validation and demonstration of prototypes of the simultaneous use of integrated devices, edge and cloud computing and communication resources in operational environments, ensuring high level of security and privacy, energy efficiency, transparency and control of the ecological footprint.

- Strategic industrial cooperation among network and data processing stakeholders which enable new revenue streams in support of viable communication infrastructures by building open platforms, underpinning an emerging industrial open telco edge cloud ecosystem to be established in Europe.

- A European vision of next generation digital infrastructures through the convergence of connectivity with interoperable edge and cloud computing services.

- Testing and validating novel approaches for cybersecurity by design and sustainability in advanced communication infrastructure.

Scope:

The recent Commission White Paper "How to master Europe's digital infrastructure needs?" highlights the convergence of electronic communications networks and cloud services, and call for the strengthening of the EU "Telco Edge Cloud" infrastructure, by creating the 3C Network (Connected Collaborative Computing).

The convergence of connectivity, including mobile networks (5G and beyond), combined with computing environments at the edge and cloud is a unique opportunity for the European

telecom industry to drive a European vision of next generation digital infrastructures and meet future processing demands of IoT and AI. Investing into future computing and connectivity paradigms will strengthen the industrial European supply side and deliver an enablement for the path towards sustainability of key sectors in the demand side.

Increased density of edge and cloud facilities is needed to sustain adoption of innovative and sovereign telco edge cloud technologies across Europe. Backed by ubiquitous connectivity to deliver the right performance in terms of bandwidth and latency, Europe's infrastructure will require advanced network management and orchestration technology as well as neutral interconnection services to guarantee efficient infrastructure utilisation and enable innovative use cases at scale.

The 3C Network large-scale pilot (focusing on the supply side) aims at setting up end-to-end integrated infrastructures and platforms, bringing together players from different segments of the connectivity and compute value chain and beyond. The main target is to validate the integration of device, network, cloud and edge computing, and communication capabilities for telco edge cloud deployments to realize a ubiquitous mesh of computing and communication resources. This will complement the Telco Edge Cloud reference deployments of Digital Europe and will feed into future deployment initiatives.

Digital autonomy in edge and cloud implies that computation infrastructure should be able to be sourced from European technology. The subsequent step following the EU investments in processors for HPC (under the EuroHPC Joint Undertaking) is to extend its success to the rest of the computing continuum. Therefore, the project will also seek to coordinate with other EU (HE) research activities with a view to integrating new processor architectures into cloud edge infrastructures as they become available.

With radical changes triggered by GenAI, as well as AI applications penetrating more and more industrial domains, demands for low latency are looming. The pilot should have to tackle the next frontier of a network evolution complementing the cloud with progress towards the edge, as well as needing reliability from the mobile networks.

Moreover, the technical solutions in the pilot should envision the use of AI to handle the optimal allocation and optimisation of the operation of the digital infrastructures resultant of the combination of distributed compute and network resources of the edge cloud compute continuum in a predictive and efficient manner and at scale. These should take into consideration the appropriate QoS trade-offs in relation to bandwidth, spectrum, computing, hardware and other functional and non-functional requirements, cater for the need for AI/ML to improve optimisation of assets and process and closed-loop automation, and target development and life-cycle management of AI models and resource management tools for the optimal management of combined and converged network, cloud and edge infrastructures.

The large-scale pilot would ideally reuse and extend relevant open-source frameworks and capitalise on existing testing and trial platforms from European or national initiatives, among which the IPCEI-CIS, SNS Stream D projects, the Cloud-Edge-IoT HE projects, and the Digital Europe Programme's Reference edge-cloud deployments, as well as research results on infrastructure and platforms. It will integrate security and privacy by design into account and seek to incorporate mechanisms such as edge discovery and deployment as-a-service delivery, end-to-end network and compute performance, energy efficiency and mobility management, including the Non-Terrestrial Network component for ubiquity.

The pilot should devise appropriate cooperation mechanisms with the Open Europe Stack action, to help defining the requirements for the development of the building blocks and ensure their integration in the pilots, including envisaging mechanisms for testing and integration of the solutions developed by the Stack.

Key aspects to be validated and demonstrated by the 3C Network end-to-end infrastructures include: multi-provider (network, edge, cloud, devices) orchestration, federation management over network and computing resources, standard ways of exposing services, interoperability, energy efficiency and sustainability, cloud-native to continuum-native software and improved network software lifecycle, IoT, Edge server density and placement issues, edge-as-service orchestration, optimisation of lightweight and cloud-native forms for Network Functions Virtualisation (NFV) and mobility management.

The pilot should help maturing the technologies resulting from medium TRLs projects, while enabling prototyping of converged telco cloud edge platforms in operational and multi-suppliers, multi-domain and multi-tenant environments.

The pilot should support the ***emergence of telco edge cloud as-a-service approaches*** that effectively apply multi-tenancy and resource sharing concepts from cloud computing into access networks, enabling effective network and compute resource sharing. In addition, the project infrastructures should cater for the pragmatic complexities associated with the physical placement of the various types of telco edge cloud platforms (near, far, regional,) across the territory considering the necessary trade-offs between performance, capacity, and costs.

Furthermore, the pilot should tackle the need for ***multi-cloud and edge service orchestration*** at scale, which enables workload portability across providers and technologies as well as effective service placement and lightweight and cloud-native forms for NFV and optimisation by means of acceleration, multi-cloud orchestration, multi-level federation and mobility management.

When appropriate, the pilot may cover research on infrastructure and platforms mid-TRLs telco edge cloud technologies, including development of telco-cloud network resources orchestration, demos, proof of concepts and early deployment of technologies.

The main achievements of the pilot should be showcased by means of small-scale demonstrations, in particular by showing a further potential use in large-scale demonstrators that could be part of future work programmes.

The pilot should provide an *open, multi-supplier, multi-vendor, and interoperable Telco Edge Cloud reference architecture and ecosystem* that encourages cooperation and cooperative development among all key stakeholders. Furthermore, the pilot must define open access policies and mechanisms that aim to maximise the impact of the provided infrastructure which take into consideration the long-term sustainability and addressing different uses by industrial and research communities. When necessary, these should explore collaboration with complementary actions addressing the demand side.

The pilot should ensure a high degree of participation of stakeholders from the relevant technological sectors, including SMEs, scaleups and start-ups, as well as properly consider the demand side from vertical sectors. In this regard, proposals should clearly define the roles and responsibilities of the participating stakeholders in developing, updating, maintaining and/ or using the technologies and services of the 3Cs network. The pilot's Consortium should also define a policy on the ownership and access of 3Cs network resources and facilities, during the Horizon Europe project and beyond.

The pilot should establish a high degree of relations and collaborate with complementary EU funded research activities, such as the SNS JU projects, the "Empowering AI across the continuum" and the "Sovereign edge/cloud infrastructure" R&I areas. They should integrate and re-use, as much as possible, results from Open Europe Stack action, IPCEI-CIS, SNS, Cloud and IoT past or ongoing EU funded research, as well as ensuring close interaction with the relevant constituencies driving that research, including the Open Europe Stack constituencies.

Moreover, the large-scale pilot should seek a clear commitment from the major European telecom, cloud and edge providers to industrialise further the results of the pilot among the major stakeholders, in particular by considering the necessary business adaptations and future perspectives, etc. In this context, an advisory group of end users should be set up to discuss and advise about user requirements to be considered in relation to the pilots. This group will collect requirements from a large range of users and test them through small demonstrations.

Links with topics in other WPs: SNS JU WP2024, DEP WP2023-2024, IPCEI-CIS

Alignment of stakeholders towards the supply-side large-scale pilot of end-to-end infrastructures integrating device, network computing and communication capabilities (CSA)

S p e c i f i c conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.8 and 2,5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 2,5 million.
Type of Action	Coordination and Support Actions
Technology Readiness Level	n.a.
Article 22.5	**NO**

Expected outcome:

The supply-side large-scale pilot (LSP) of end-to-end infrastructures integrating device, network computing and communication capabilities will develop horizontal facilities for the benefit of constituencies represented in the supply LSP and also beyond, including those focusing on the demand side of the referred infrastructures. This CSA will bring together all those stakeholders. In any case, the CSA action should be prepared, managed and coordinated by key stakeholders in the field.

The expected outcomes are the following:

- Coordination of the different stakeholder communities in the scope of the supply LSP work (software, hardware, computing, telcos, AI, cloud...), bringing stakeholders together to work on a common plan and technology roadmap on supply and demand of end-to-end infrastructures integrating device, network computing and communication capabilities, monitoring implementation and identifying gaps.

- Enable the supply-side LSP to consider the demand-side perspective, , including requirements from the different applications/user communities.

- Help stakeholders build small, and later larger-scale, demos based on the developments of the supply-side LSP, as well as developments from future Horizon research actions as possible and appropriate.

- Assist stakeholders from the different segments of the value chain (telecoms, software providers, middleware stack providers, etc.) to converge towards a shared approach, while modular and flexible, for telco-edge-cloud infrastructure and services

- Put in place mechanisms for exchange, collaboration and shared governance to facilitate smooth cooperation between supply and demand-side activities, including the Open Europe Stack, towards a common platform approach across industrial actors, including a repository with critical mass of largely open-source building blocks, as well as maintenance and support services.

Scope:

The expected scope of the CSA for this governance mechanism to function would be the following:

- Consolidate priorities and maximise benefits across different demand perspectives and timelines for key infrastructure services to be implemented.

- Ensure alignment of demand and supply side strategies and roadmaps, in line with (and contributing to) the White Paper on communication infrastructures and other relevant EU policy.

- Ensure coordination and integration of the work of the actions on the supply side pilot and the Open Europe Stack.

- Open-source delivery of Telco Edge Cloud building blocks by the supply side pilot, which will be the foreseen backbone to articulate the cooperation among supply- and demand-side LSPs.

- These open-source modules should be aligned with industrial interests and with the currently embryonic developments at IPCEI-CIS Linux Foundation Telco Edge Cloud initiatives (i.e. Sylva and CAMARA).

- The demand-side developments in the relevant verticals will offer a continuous feedback loop to the supply side endeavours, while they will benefit from the progressive developments of the supply LSP.

- Provide a foundation for exploitation of European technology developed under the 3C initiative as an alternative to the platforms led by large multinationals. The project

should provide a forum for consultation and input of the demand-side application sectors and verticals into the development of the supply-side architecture and building blocks.

- Identification of paradigms shifts evolving in relevant vertical domains like virtual worlds as a driver for emerging network virtualisation and performance as well as vertical services like mobility, communities or energy.

- Assessment of monetising edge computing, interoperability of middleware and SW framework through trend scouting on markets, value chains and ecosystems in the area of dynamic content delivery, AI adoption for telco operation and edge computing, convergence across the telco-cloud-edge- IoT continuum.

Roadmap for next generation computing technologies from IoT device level to edge to cloud to HPC (CSA)

S p e c i f i c conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.8 and 2.5 million would allow these outcomes to be addressed appropriately for a three years timeframe. 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 2.5 million.
Type of Action	Coordination and Support Actions
Technology Readiness Level	n/a.
Article 22.5	No

Expected outcome:

The CSA action should be prepared, managed and coordinated by key stakeholders in the field. 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 computing 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, support to artificial intelligence, use of generative AI for computing system engineering, etc.

Scope:

To support the European Commission and the European computing constituency by providing to them annually updated roadmaps for research and innovation related to computing. This topic is overarching and building the bridge between Destinations 3 (heading "From Cloud to Edge to IoT for European Data"), Destination 4 ("Ultra Low Power Processors"), as well as the Joint Undertakings (JU) on Chips, Smart Networks and Services, and high-performance computing (HPC). This effort builds on the achievements and structures established by the HIPEAC project and think tank of all renowned European research centres on computing "at large" and their key experts. Both the academic visions as well as the industrial perspective complementing the Strategic Research and Innovation Agendas of the JUs should be taken into consideration.

Open Europe Stack: development of technological commons/open-source 3C building blocks (RIA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of EUR 10 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	N/A
Article 22.5	**NO**
Financial Support to Third Parties	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 400 000 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 70% 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:

- A publicly available and operational stack of strategic commons focusing on internet technologies for trust, transactions, connectivity, and decentralisation implementing the European vision of next generation digital infrastructures, in particular the 3Cs networks (in close cooperation with the 3Cs large scale pilots), and the wider Web 4.0.

- A library of inclusive, trustworthy, interoperable, and human-centric applications and services leveraging open-source commons building blocks which will increase the value of the network in the respect of European values.
- A flourishing European ecosystem of contributors to digital commons– e.g., individuals, SMEs, academics - stimulated by critical challenges around sovereignty, trust, and user empowerment.
- Tools, services, and in-sights supporting compliance with and implementation of EU legal framework e.g., EUDI, CRA, DMA, DSA, GDPR.

Scope:

This action will foster an open-source framework, developed through commons, i.e. open source software governed by communities of contributors, that will provide key technology components for the operation of the 3C large scale pilot. They will be addressing relevant areas, structuring them in a stack and supporting the development of 3C building blocks making them available through a library of digital commons supporting applications on top of the European providers ecosystem.

It will <u>mainly</u> cover three technology areas:

- Trust technologies such as privacy enhancing technologies, AI-based agents and trusted technologies for identities allowing exchanges across multiple 3C networks, providing the users with transparent, auditable, secure, and resilient building blocks and tools across the internet stack.
- Transactional technologies enabling the full cycle of asset transaction, resource access and attribute verification between users, authoritative parties, and providers of resources and services.
- Decentralised technologies for an immersive world notably based on open standards ensuring interoperable flow of data and events across the 3C pilot <u>networks</u> and operators.

In order to implement the European vision of next generation digital infrastructures (3Cs networks), applicants should devise appropriate mechanisms for cooperation with the 3C Pilot:

- To ensure the integration of requirements and specifications stemming by the 3C Large Scale Pilots.
- To ensure the 3C Large Scale pilot's swift integration of the building blocks developed by the Open Europe Stack, including envisaging mechanisms for testing and integration of the solutions.

Applicants should provide concrete plans on how such work should be organised in close cooperation with the 3C large scale pilot.

Applicants could also decide to select and fund third party projects, wherever required, through up to 15% budget of their project's financial support to third parties based on excellence and addressing requirements for transparency, publicity, confidentiality, fair treatment, and adequate handling of conflict of interest.

If applicants opt for financial support to third parties, they should publicise calls towards the open-source communities actively influencing the course of the Internet. The calls should aim at improving trust, transactions, decentralisation implementing optimal balance between distribution, security, AI usage and energy efficiency targeting climate neutrality objectives. Applicants should then also define the mechanisms for maturing third parties' projects e.g., security and accessibility audits, packaging of the stack for easy deployment, localisation of the software in EU languages, documentation best practices, performance optimisation 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.

In addition to contributing to the 3C large scale pilot, applicants should demonstrate how the software produced will be operationalised as a stack of open libraries accessible through a common European repository and maximising re-use, reproducibility, and resilience for adopters.

Applicants should actively manage the portfolio of funded projects and provide a coherent overall picture in relation to the 3Cs objectives, describing how mature solutions are and ensuring trusted and easy deployment capabilities for each building block through packaged stack.

Applicants should strive for identification of common tools and stimulate maximum re-use of components coming from other funded projects e.g., interoperable identity and credential management tools, common packaging solutions, tools for decentralised social media.

Applicants should seek active collaboration with other initiatives addressing internet commons of relevance to 3Cs 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.

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 lifecycle, 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 36 months would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations.

Preparing the Advancement of the state of the art of submarine cable infrastructures (CSA)

S p e c i f i c conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 1.9 and 2.1 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 2.1 million.
Type of Action	Coordination and Support Actions
Technology Readiness Level	n.a.
Article 22.5	**YES**

Expected outcome:

Defining specific R&I roadmap at EU level to establish leadership in all relevant submarine cable technology domains (EU research roadmap on submarine cables). This CSA should be prepared, managed and coordinated by the key stakeholders in this field.

The project should take into consideration the overarching challenges of:

- Reinforcing European leadership in submarine cable connectivity, with European capabilities and best practices shaping future connectivity standards;

- A digital and green transition towards low carbon footprint of connectivity platforms; and

- Ensuring resilience for the most demanding cases requiring a very high grade of quality of service (QoS) and performances.

Against this background, the objectives of the target support actions are outlined below:

- Analysis and definition of the expected critical hardware and software components of future submarine cable infrastructure systems, and indication on where Europe should seize opportunities and strengthen its capabilities, taking into account the characteristics and architectures, including components, security, and operations of future submarine connectivity infrastructures;

- Definition of the main required R&I work and assessment of associated research investment needs related to the identified domains;

- Definition of an appropriate industry roadmap (SRIA), in close partnership with relevant EU actors both from industry and academia, indicating research & innovation actions to be undertaken in priority, their scope, and a timetable showing the main milestones and targets. The project could envisage organising thematic workshops to consult all interested communities.

Scope:

- Enabling technologies applicable to submarine connectivity infrastructures and systems are increasingly important to ensure Europe's strategic autonomy as well as economic security. Achieving such goals requires that Europe remains at the technological edge not only with regards to the cable technology itself but also all the other critical elements composing the submarine cable infrastructure such as repeaters, landings stations, operational control centres, or cable communications cybersecurity.

- While some of the necessary research is indirectly conducted through mainstream research activities in generic technologies (e.g., optical communications or network management software), more specific research is needed to address the particular needs and advancement of submarine cable infrastructures and systems. However, the specific research needs still need to be identified, which supports the need to develop a specific roadmap and SRIA for research and innovation in submarine cable technologies. Such research efforts may address some of the following (non-exhaustive) domains: Multi-core fibre (MCF) technology, Digital Signal Processing, repeater systems, intelligent sensing, advanced Digital Acoustic Sensing (DAS), logical layer and cable network management systems, robotics to improve the construction, maintenance and repair of submarine cable infrastructures, and other innovations.

Photonics

Active sensor technologies and multimodal sensor integration for multiple application domains (IA) (Photonics Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 4 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 25 million.
Type of Action	Innovation Actions
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.
Article 22.5	**NO**

Expected outcome:

Photonics sensor technologies enable precision and versatility in sensing across multiple domains. The integration with multimodal systems enhances data accuracy and speed. Advancements in photonics sensors and their multimodal integration aim to elevate diagnostics, monitoring, and environmental sensing by improving efficiency, performance, and reliability while reducing size and manufacturing costs.

The development of sensor technologies and multimodal integration is closely aligned with several key EU policies. These include achieving open strategic autonomy in digital and emerging enabling technologies, enhancing Europe's technological sovereignty, and supporting the twin transition to a digital and green economy by promoting energy-efficient, competitive, and resilient digital infrastructures.

The initiative also aims to advance the digital transformation by providing access to high-quality environmental data, supporting the development of technologies for privacy, compliance, and data integrity to empower decision-making and foster a fair data economy.

Lastly, it contributes to the green transition by leveraging photonics sensor technologies for environmental monitoring and sustainable practices. It aligns with the EU's objectives for a green and digital economy, enhancing system operations and promoting innovation in eco-friendly practices, thus strengthening Europe's technological leadership for societal and economic progress.

Projects are expected to contribute to at least three of the following outcomes to fully exploit the potential of photonics for a digital, green and healthy future in Europe:

- Increase the efficiency of developed photonic sensors, surpassing existing technologies in aspects such as energy consumption, data processing speed, and measurement accuracy.

- Significantly reduce the size, weight, or footprint of the sensors and quantify advancements over current technologies.

- Improve both intrinsic and extrinsic performance metrics to boost measurement accuracy across various user-case challenges.

- Contribute to reducing manufacturing costs and increasing resource-efficiency, while also enhancing reliability and durability of the targeted sensor systems.

They are additionally expected to:

- Help secure the strategic autonomy for Europe by ensuring intellectual property and production means of key technologies are maintained within the EU, reducing dependencies and enhancing negotiation power in technological cooperation.

- Help maximise international competitiveness by increasing the uptake and translation of photonics technologies into new products and services, guided by key technology requirements.

Scope:

The scope of this call focuses on the advancement and application of photonics sensor technologies and their integration into multimodal systems. Proposals are expected to address the development of sensor technologies and their validation through trials in realistic use cases. This includes exploring multi-modal sensor capabilities, as well as employing sensor fusion and machine learning approaches for the analysis of sensor data. Techniques should address at least two of the following areas:

- LiDAR

- 3D sensing and imaging

- Communication fiber sensing

- Optical coherence tomography (OCT)

- Chemical sensing

- Bio- and medical sensing and imaging

- Particle sensing

- Integrated photonic solutions

In addition, the proposals could focus on developing and integrating algorithms designed to enhance the processing capabilities and decision-making accuracy of photonic sensors. These algorithms may help to optimize the interpretation of complex sensor data, enable real-time analytics and adaptive responses in dynamic environments.

Furthermore, projects should aim to provide significant improvements in at least two of the application domains listed below. This expectation underlines the call's objective to foster innovations that have a substantial and beneficial impact on society and various industry sectors:

- Healthcare (medical diagnostics, treatment through improved imaging techniques and diagnostic accuracy).

- Transportation Safety (enhanced safety features in automotive and aerospace industries through better sensing capabilities).

- Industrial Efficiency (industrial processes such as manufacturing, quality control, and automation through improved sensing technologies).

- Agricultural/Food Sector (precision agriculture, food safety, food waste reduction and supply chain management through improved sensing techniques for monitoring crop health, detecting contaminants, and optimizing production processes and raw material utilisation).

- Environmental Monitoring and sustainable energy (pollution monitoring, climate research, renewable energy infrastructure and natural disaster mitigation).

- Security and resilience of people and critical infrastructure (face identification, long distance observation by day and night, (infra-)structural health monitoring, gas sensing, explosive detection)

- Protection and efficient operation of optical communications, risk management of data transport and processing.

Proposals submitted under this topic should include a business case and exploitation strategy.

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

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.

Quantum and High-Performance Computing

Continuation of the Quantum Technologies Flagship (CSA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 4 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 4 million.
Type of Action	Coordination and Support Action
Article 22.5	**NO**
Lump-sums	**NO**

Expected outcome:

The new Quantum Flagship CSA is expected to:

1. Act as a global observatory of quantum technologies, systematically reporting on the latest advancements and breakthroughs occurring worldwide. It will provide regular assessments to the European Commission and Member States, specifically to the Quantum Expert Group of the Quantum Pact, offering a detailed analysis of Europe's standing relative to global competitors. This will ensure Europe can strategically respond to emerging trends and innovations.

2. Capitalize on the accomplishments and infrastructure (e.g. online presence) established by the current CSA to further elevate Europe's leadership in quantum technologies.

3. Provide comprehensive support to Flagship projects, researchers, and innovators, fostering synergies, knowledge sharing, and best practices.

4. Develop and implement targeted communication strategies to raise awareness and understanding of quantum technologies across varied audiences, including students, specialists, and the general public.

6. Promote the sustainable growth of quantum technologies in Europe by exploring new applications and markets, ensuring the field's dynamism and competitiveness.

7. Serve as a pivotal entity for coordinating efforts between the EU and Member States, especially in light of the new Quantum Pact. This includes aligning national and European strategies and enhancing international relations to fortify Europe's stance in the global quantum landscape.

8. Assist the Flagship's governance bodies and facilitate the integration of new structures or initiatives, ensuring a cohesive and efficient approach to advancing quantum technologies in Europe.

Propose a clear, service-oriented model detailing the CSA's offerings to various stakeholders, including research support, business intelligence, strategic analysis, international collaboration facilitation, event organization, and communication activities.

Scope:

The scope of the new Quantum Flagship CSA encompasses the following aspects and should be prepared, managed and coordinated by the key stakeholders in this field.:

1. The global observatory role of quantum technologies, systematically reporting on the latest advancements and breakthroughs occurring worldwide.

2. Fulfil the dissemination requirement of five articles every two months highlighting EU success stories in quantum technologies. These articles must be widely promoted across Europe via social media, popular newspapers, and technical magazines to ensure maximum visibility and impact.

3. Building upon the established infrastructure by the previous CSA, support the European Commission and current and future projects within the Quantum Flagship, including organisation of events and ensuring they have access to the necessary resources and expertise.

4. Developing comprehensive communication plans tailored to different target audiences, enhancing the visibility and understanding of quantum technologies and their societal implications.

5. Acting as a central hub for coordinating actions between the EU, Member States, and international partners. This involves compiling and disseminating information critical for harmonizing strategies at different levels.

6. Providing support to the Flagship's governance structures, contributing to the smooth execution of its strategic vision and operational goals. This may include aiding the establishment and integration of new bodies or initiatives.

Proposals should also contribute to spreading excellence across Europe; for example, through the involvement of EU Widening Countries.

Links with topics in other WPs:

HORIZON-CL4-2021-DIGITAL-EMERGING-01-32: Support and coordination of the Quantum Technologies Flagship Initiative (CSA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 32,5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 32,5 million.
Type of Action	Specific Grant Agreement
Technology Readiness Level	Activities are expected to start at TRL 4-5 and achieve TRL 6-7 by the end of the project – see General Annex B.
Article 22.5	**YES**

<u>Expected outcome:</u>

Proposals submitted under the SGA2 for the FPA on "Building the Quantum Internet" are expected to achieve the following outcomes, building on the progress made by the SGA1 and demonstrating concrete steps (in terms of improved functionality, distance and accessibility) towards the realisation of a quantum internet:

1. The realization of quantum communication technology that is scalable, reliable, and ready for manufacturing.

2. The achievement of entanglement distribution over distances reaching or exceeding 500 km, incorporating quantum repeaters and demonstrating feasibility for global quantum internet infrastructure over a real-world communication network.

3. Prototype (lab condition) of a long-distance quantum communication fibre network using quantum repeaters capable of connecting metropolitan area networks over hundreds of kilometres and demonstrate interoperability of various approaches and scalability of the architecture.

4. The integration of advanced quantum network applications (e.g., secret key sharing, distributed quantum computation, blind quantum computation) into classical network

infrastructure (i.e. orchestration platform) over a quantum network including quantum repeaters.

5. Platform-independent software and network stack demonstration that can operate on a quantum communication network involving at least two quantum computing nodes with quantum memories, ensuring the network's resistance to known forms of cyber-attacks.

Scope:

The Second Specific Grant Agreement (SGA2) under the FPA for building the Quantum Internet should focus on making significant steps towards the practical realization of a quantum internet:

• Develop the foundational technologies and network architectures needed to establish a quantum internet that interconnects quantum computers, simulators, and sensors through quantum networks.

• Propel the innovation and deployment of quantum repeaters capable of operating across extensive real-world networks.

• Encourage collaboration across disciplines and sectors to address the technological, computational, and societal aspects of building the quantum internet.

• Contribute to the development of international standards and ensure interoperability across different quantum technologies, facilitating the secure and efficient exchange of quantum information.

• Highlight the project's contribution to economic growth, technological sovereignty, and strategic advantages in global quantum technology leadership.

• Engage with potential end users of the technological developments and enable advanced use cases of a quantum internet.

Proposals should also contribute to spreading excellence across Europe, for example, through the involvement of EU Widening Countries.

Links with topics in other WPs:

HORIZON-CL4-2021-DIGITAL-EMERGING-02-19: Framework Partnership Agreements in Quantum Communications (FPA)

Quantum Computing – complementing the quantum computing FPAs with the development of a technology agnostic software stack (RIA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 4-6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B.
Article 22.5	**YES**

Expected outcome:

Proposals under this call are anticipated to achieve pivotal advancements in quantum computing by:

1. Establishing a universal, interoperable quantum computing ecosystem that supports diverse hardware platforms through the creation of technology-agnostic software stack.

2. Seamlessly integrating quantum computing with classical computing systems, including HPC and cloud services (including the European High Performance Computing Joint Undertaking's supercomputers, and the quantum simulators already integrated into them), and demonstrating practical quantum computing applications by showcasing use cases that combine quantum and classical computing capabilities

3. Advancing the development of standardized software architectures, compilers, and simulators that ensure application portability and performance across different quantum computing platforms.

4. Advancing integration of quantum simulators with HPC systems.

5. Demonstration of workflows that effectively combine quantum and classical computing to address complex computational challenges, providing clear examples of the added value of quantum acceleration.

6. Support for initiatives aimed at training software developers in quantum programming and developing libraries for basic quantum algorithms, including the integration of quantum error correction mechanisms.

For all the above outcomes, the use of appropriate software licenses, such as those listed as free by the Free Software Foundation and listed as open source by the Open Source Initiative, is strongly recommended. Moreover, the beneficiaries will have to ensure open access to other research outputs like data and workflows under the principle 'as open as possible and as closed as necessary'.

Scope: Quantum APIs and cloud access form the transition layer between users and quantum machines in the quantum computation stack. This layer includes general-purpose quantum software development kits that are used to implement quantum algorithms for both gate-based systems, simulators and quantum annealers. This call seeks proposals that address the creation of a cohesive software stack that is agnostic to quantum hardware, facilitating the development, testing, and deployment of quantum applications across various platforms.

Projects are expected to deliver results under Open Source licenses and shall include source code and data sets used as part of open repositories available to the EU community at large.

Proposals should also contribute to spreading excellence across Europe; for example, through the involvement of EU Widening Countries.

Links with topics in other WPs:

HORIZON-CL4-2021-DIGITAL-EMERGING-02-17: Framework Partnership Agreement for developing large scale quantum simulation platform technologies (FPA)

International cooperation: joint research and development with international partners (RIA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of EUR around 2.5 to 2.7 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 8 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 2-3 and achieve TRL 3-4 by the end of the project – see General Annex B.
Article 22.5	**NO**

<u>Expected outcome:</u>

The overall objective of this call is to support the implementation of the EU-Republic of Korea Digital Partnership by strengthening cooperation with Republic of Korea (ROK) in quantum technologies, in the areas identified in the Partnership.

Joint EU-ROK proposals are expected to contribute to the following outcomes:

- Strengthening the European quantum ecosystem, enabling stakeholders to enhance quantum technologies' applications in academic, industrial, and relevant cases for the EU and ROK.

- Improving the exchange of information and expertise to tackle societal challenges utilizing quantum technologies.

- Sharing best practices in deploying quantum technologies and integrating them with other technologies.

- Facilitating researcher and engineer exchanges between the EU and ROK for mutual access to quantum infrastructures.

- Enhancing international cooperation between the EU and ROK quantum communities, with a roadmap for future collaboration in targeted areas.

<u>Scope:</u>

Proposals for the Joint Call EU-ROK are expected to address quantum technology challenges in the fields of quantum communication, computing, simulation, and sensing, identifying the added value and mutual benefits for both EU and Korean partners. This includes integration across various disciplines such as physics, engineering, computer science, cybersecurity, theory, algorithms, software, manufacturing, control, infrastructures, etc.

Relevant technological and societal challenges to address include:

• Co-design of hardware and software to accelerate quantum computing and simulation applications, ensuring interoperability across platforms and foundational quantum algorithm and architecture theories.

• Development of secure quantum communication protocols, including quantum key distribution and beyond, with a focus on device independent protocols, quantum network architecture, and certification of quantum states.

• Application-specific quantum sensor development, covering areas like device fabrication, characterization for purposes like navigation, imaging, and biomedical applications, and optimizing sensor control and advanced approaches.

Proposals should clearly define the benefit of EU-ROK collaboration, aiming to enhance the technology readiness level (TRL) through comprehensive engineering approaches involving public and/or private partners.

Proposals should also contribute to spreading excellence across Europe; for example, through the involvement of EU Widening Countries.

International cooperation: Joint or coordinated calls

Proposals must be submitted by consortia involving entities from both the EU and ROK.

Participants are expected to adhere to the rules of participation and funding outlined in the Horizon Europe Framework Programme.

All proposals must include a detailed plan for collaboration, including objectives, methodologies, and expected outcomes.

Post-exascale HPC (CSA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 2,5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 2,5 million.
Type of Action	Coordination and Support Action
22.5	NO

Expected outcome:

* Delivery of a high-quality roadmap addressing the post-exascale HPC research challenges for applications, algorithms, software, hardware and systems

* Contribution to the development of a competitive European converged HPC/Quantum/ AI ecosystem

* Interaction and collaboration with similar international efforts

Scope:

Proposals are invited for a Coordination and Support Action that will guide and prepare European HPC for the post-exascale era of converging supercomputing, quantum computing and artificial intelligence worlds. This CSA should be prepared, managed and coordinated by the key stakeholders in this field.

The action should bring together the key scientific and industrial players in Europe and should liaise with RIAG, INFRAG, ETP4HPC, international post-exascale efforts, DARE FPA on RISC-V hardware, CoEs and other relevant European projects and initiatives.

The action should analyse the research challenges of all relevant technologies in the post-exascale era and produce and maintain a high-quality research roadmap with recommendations for research actions at the European level. Issues like hardware-supported mixed-precision, HPC as a service, real-time HPC, digital continuum, convergence of HPC/AI/Quantum/Cloud/Edge, should be part of the analysis.

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.

2-Dimensional Material/Graphene

Innovative Advanced Materials (IAMs) for photonics, enabling low-power and ultra-broadband performance for telecommunication (IA/RIA) (New European Partnership on innovative materials)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 3-4 and achieve TRL 5-6 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

- Demonstrated added value of Innovative Advanced materials (IAMs) for integrated photonic devices and systems, with focus on low power consumption, enabling future telecommunication networks in which Europe can build competitive value chains.

- IAMs for miniaturized and outperforming photonic integrated technologies e.g. in terms of performance, power, cost, enabling the development of future-proof, scalable, low-power and high-bandwidth devices.

Scope:

IAMs can be the ideal candidate for several applications in photonics and optoelectronics. These include ultrafast integrated photonic circuits, with modulators, waveguides, detectors, emitters and switches, which play a crucial role in the ongoing quest to increase the speed of data transmission in telecommunications networks. In addition, they find utility in high-frequency transmitter modulators and receiver demodulators, which are essential for advancing wireless telecommunications technologies. They can also serve as integral components in optical interconnects for data centers, high-performance computing (HPCs), and artificial intelligence/machine learning (AI/ML) computing systems.

The main objective of this call is to explore innovative solutions based on IAMs, including 2DMs, that offer state-of-the-art performance and low power consumption, while

demonstrating scalability for volume production, thus exploiting the Si manufacturing infrastructure. The envisioned compact devices will be designed to be compatible with low-power driving electronics and thus reduce energy consumption. Solutions should be compatible with existing photonic integrated platforms and low-voltage electronics.

Proposals are expected to integrate the value chain and include relevant manufacturing technologies required to bring the developed devices to market. Prototypes will be developed using packaged devices, including electronics, to enable testing in relevant environments.

Efforts will be focused on envisioning optimized routes for electronic and photonic design, fabricating photonic circuits, producing IAMs, conducting testing, executing wafer-scale fabrication, and performing co-integration and co-packaging, ultimately leading to demonstrations of the developed technologies and their added values.

Proposals investigating 2D materials are expected to develop synergies and relate to activities and outcomes of the projects at the core of the Graphene Flagship[2]. Such proposals should also cover the contribution to the governance and overall coordination of the Graphene Flagship.

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[2] Graphene Flagship: https://graphene-flagship.eu/

Innovative Advanced Materials (IAMs) for conformable, flexible or stretchable electronics (RIA) (New European Partnership on innovative materials)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 10 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 2-3 and achieve TRL 4-5 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

- Conformable, flexible or stretchable electronic devices and circuits, enabling improved user experience and adoption;

- Sustainable electronics based on low environmental impact materials, promoting reparability and/or recyclability and compatible with energy and resource efficient manufacturing processes;

- Materials tailored for solution-processed electronics such as semiconductor, conductive, dielectric, electroactive polymers, etc. enabling high performance and reliable flexible electronics devices.

Scope:

The concept of "ubiquitous electronics" can be a unique opportunity for the EU, opening up new avenues for e.g., wearable electronics, e-textile, e-skin, wellbeing solutions and Internet of wearable things (IoWT), which represent strategic markets for the EU. Innovative and advanced materials (IAMs) can enable new technologies and the much-needed paradigm of an electronic device that can adapt to any substrate. Despite the progress made in this field, current devices are made up of a limited proportion of flexible, conformable, and stretchable components, mainly sensors, while the rest of the circuit remains rigid, limiting this technology shift.

The overall objective is to discover Innovative Advanced Materials (IAMs), including 2DMs, with improved properties in terms of flexibility, conformability and stretchability that can enable novel flexible electronic applications, with a focus on environmentally friendly technologies with reduced carbon footprint processing. Proposals should address all of the following challenges:

- Discomfort of existing wearables leading to non-adoption

- Environmental impact of current electronics due to the use of hazardous and/or critical raw materials, energy-hungry and resources intensive processes

- Low or limited performance and durability of existing materials for high performance and reliable flexible electronic devices and circuits

- Limited integrability of current electronics: size and/or weight, complex cabling, interface between flexible and rigid components, design limitations (i.e., pattern geometry, thickness, dimensions).

Proposals should address reparability and/or recyclability of devices and circuits e.g. reversible adhesives and interconnects, low temperature soldering, bio-based or recycled substrates such as low thermal budget paper and inks, etc., compatibility with energy and resource efficient manufacturing processes e.g., printing, thermoforming, lamination, injection moulding, etc.

Proposals investigating 2D materials are expected to develop synergies and relate to activities and outcomes of the projects at the core of the Graphene Flagship[3]. Such proposals should also cover the contribution to the governance and overall coordination of the Graphene Flagship.

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[3] Graphene Flagship: https://graphene-flagship.eu/

Virtual Worlds

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 5 and 6 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 43 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 3-4 and achieve TRL 6 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

Proposals are expected to contribute to developing core technologies for Virtual Worlds, with a focus on better, more realistic and more performant interaction and immersion, at application and components levels. The following outcomes are expected:

A) Better and more realistic immersion through multimodal interaction.

- Improve the multimodal immersion experience combining eXtended Reality with advanced and innovative technologies

B) Innovative photonics technologies for projection, sensing and perception in virtual worlds.

- Improve the performance of microdisplays or sensing devices serving Virtual Worlds by using innovative Optics and Photonics technologies.
- Improve the user experience beyond the state-of-the-art by assessing the human perception and experience from subjective, objective, and functional perspectives and taking into account the specific properties of the targeted devices as well as privacy, security and safety requirements.

Proposals are expected to address at least one of the expected outcomes, either type A) or B). The type must be clearly identified within the proposal, Special attention will be given to proposals including transdisciplinary research (encompassing Type A) and B)) in order to deliver and enhance uptake of suitable, accurate, ethical and safe solutions.

At least two proposals in each of the areas defined below will be selected. Proposals should clearly identify the area they are addressing.

Proposed applications should aim at increasing awareness, acceptance and adoption of virtual worlds applications across sectors.

Scope:

Virtual worlds will impact the way people live, work, create and share content, the way public administrations interact with citizens as well as the way businesses operate, innovate, produce and interact with customers.

Multimodal interaction and immersion are key dimensions of Virtual Worlds and will be supported by innovative optics and photonics technologies to achieve the full potential of Virtual Worlds core technologies.

A broader adoption of Virtual Worlds will need better and more realistic immersion and interaction, mixing modalities, sensors and actuators for an ever-improved user experience: touch, smell, haptics, etc will be better stimulated, bringing users closer to real-world sensations, serving Virtual Worlds.

Many challenges remain to be addressed to realize optics and photonics technical solutions that offer high-performance, excellent visual quality, high-quality user experience, and sustainable services and devices, for head-mounted displays (HMD), autostereoscopic displays or sensing devices.

Coupled with display and sensing technologies, algorithms and metrics should be considered to exploit the underlying light (transportation) models given the utilized modality and address e.g. scene representation, content generation, compression, transmission, content reconstruction, content-to-display adaptation, or rendering. Moreover, the quality of integration, both from a user and technological perspective, will be essential for a broad adoption of Virtual Worlds.

The type A) proposals under this topic should develop and demonstrate novel applications for Virtual Worlds that combine several modalities and aim to provide seamless and more realistic immersive interactions. Proposals should investigate novel scientific approaches or push the limit of existing ones to improve the synchronization and integration of the different modalities.
Proposals should focus on an enhanced use of multimodal technologies, integrating at least two modalities within an extended reality application. Modalities include haptics and force-feedback, vision, touch, smell, speech, etc.

The type B) proposals should address the development and integration of advanced innovative and high-performance Optics and Photonics technologies for display and sensing devices serving Virtual Worlds.

- o For displays further improve current high-end microdisplays regarding power consumption (<1 mW), device efficiency, resolution (8K and beyond, pixel densities > 10kppi), high dynamic range (HDR), colour gamut, contrast and refresh rate holding the promise for truly immersive experiences;
- o For sensing devices improve accuracy in diverse lighting conditions and with different eye physiologies

Special attention should be given to the design and fabrication of suited waveguide optics, holographic elements, diffractive optics, reflective light guides, freeform optics, or meta-surfaces with optimal optical properties and behaviour; to support the required field of view (FoV), to be lightweight and safe for the user, and provide excellent colour uniformity and high brightness efficiency; to satisfy the use case requirements for both professional use and mass adoption, i.e., be scalable to large volumes and cost-effective; to integrate targeted systems seamlessly into mixed-reality devices without increasing bulk or reducing comfort.

For proposals type A) and B), the quality of integration, both from a user and technological perspective, will be essential for a broad adoption of Virtual Worlds. The proposals should include a focus on human perception and experience, from subjective, objective, and functional perspectives , and take into account EU values such as inclusivity, privacy, security and safety of users and their personal data. Solutions should guarantee the privacy and rights of individuals and companies and ensure secure and trustworthy interactions to deliver and enhance uptake of suitable, accurate, ethical and safe solutions.

The Consortium should pay attention to developing solutions that are reliable, robust and interoperable. Proposals should leverage existing open standards and technologies in the domain of eXtended Reality. Applications should be tested and anchored in real world environments and aimed at least one application domain.

We consider that proposals with an overall duration of typically 36 months and a budget of EURO 5-6 M€ would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of proposals requesting other durations.

This topic is implemented through a joint effort from the co-programmed European Partnership for Virtual Worlds and the Photonics Partnership.

Generative AI for Virtual Worlds: Advanced technologies for better performance and hyper personalised and immersive experience (IA) (AI/Data/Robotics & Virtual Worlds Partnerships)

Generative AI is a general technology that is accessible, powerful and adaptable to a vast range of uses and has the potential to revolutionise human-machine interaction and enhance productivity across value chains and organisational functions, laying the foundation for novel economic activities.[4]

Generative AI will enable creators to build on the spot, adaptable, realistic or innovative characters, user-tailored artefacts and Virtual Worlds, or creative breathtaking divergent worlds and landscapes. AI generated smart digital assistants and 3D chatbots will be helping users to navigate safely and inclusively.

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of between EUR 4 and 5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 20 million.
Type of Action	Innovation Actions
Technology Readiness Level	Activities are expected to start at TRL 4-5 and achieve TRL 7 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

Projects are expecting to contribute to the following outcomes:

- Realistic, creative and innovative characters, user-tailored artefacts, and Virtual Worlds for a better immersion and significantly improved user experience.

- Smart digital assistants and 3D chatbots for a safe and inclusive navigation

Scope:

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[4] Communication on boosting startups and innovation in trustworthy artificial intelligence Com(2024) 28 final of 24 January 2024.

Generative AI, at the edge and integrated in devices, will bring better performance, a more personalised and a more immersive experience for an inclusive and wider adoption of Virtual Worlds. Small and frugal AI models would enable faster inference contributing to lower latency while improving security and privacy by processing data closer to the user, preserving EU Values. Smart digital assistants will accompany users throughout their journey within Virtual Worlds, bringing new innovative communication modalities, advancing collaborative intelligence and decision-making AI capabilities.

The following type of innovation actions proposals are expected:

Generative AI – Realistic and innovative Virtual Worlds for a better immersion:

Proposals should use Generative AI to build on the users' expectations to create either safe and inclusive virtual spaces, realistic environments, or creative and beyond reality ones. They should develop dynamic Storytelling and scenarios to enable creative content that is personalised leading to unique experiences for the users or shared with other users. They should also use AI to enable generation of personalised avatars aiming to provide seamless and more realistic immersive interaction.

Generative AI – Smart digital assistance for a safe and inclusive navigation in Virtual Worlds:

Proposals should develop smart digital assistants and 3D chatbots (AI-enhanced communicating 3D avatars), to for example, enhance training and education, remove language barriers or language disorders through instant translation, including sign languages, offer sentiment analysis and behavioural decision support systems, enable users to adapt to various interlocutors from various cultures, languages and backgrounds, contributing to navigate in inclusive and safe Virtual Worlds, while offering users new adapted learning modalities. When relevant, proposals can capitalise on latest developments in generative AI, to bring step change in explainable collaborative intelligence and decision-making capabilities by dedicated specific research.

Drive the evolution of the internet towards open and interoperable Web 4.0 and Virtual Worlds : building blocks in priority areas (RIA) (Virtual Worlds Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of EUR of around 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 14,5 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	N/A
Article 22.5	**NO**
Lump-sums	**YES**
Financial Support to Third Parties	Beneficiaries may provide financial support to third parties. The support to third parties can only be provided in the form of grants. The maximum amount to be granted to each third party is EUR 150 000. This is justified by the possibility for a third party to participate during the full duration of the pilot.
	A maximum of 15% of the total requested EU contribution may be allocated to financial support to third parties, selected through open calls.
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, grants will be awarded to applications not only in order of ranking but at least also to one application that is the highest ranked within each area, provided that the applications attain all thresholds.

<u>Expected outcome:</u>

- o An early demonstration of the future Web 4.0 architectural framework (including protocols and standards) made up of key open source internet building blocks in

priority areas: identity, software supply chain, open hardware, decentralised solutions & virtual worlds.

- The emergence of open and interoperable Web 4.0 and Virtual Worlds supported by EU based internet ecosystems centred on EU values and regulatory framework with high socio-economic impact, through the application of digital commons technologies and other open-source solutions and open standards in several use cases.

- Supporting the transition from today's internet towards Web 4.0 where end-users have access to a more personalised and interactive experience through more collaborative, decentralised and user-centred approaches. Special attention will have to be given to security, scalability, and accessibility issues.

- New business opportunities and the emergence of new business and sustainability models based on Open Source.

<u>Scope:</u>

The aim of this topic is to advance the evolution of the internet towards open and interoperable Web 4.0 enabling Virtual Worlds, ensuring seamless user experience navigating across platforms by increasing the take up of digital commons technologies and other Open Source solutions in Europe. The action will thus leverage the strong and active community of European open-source innovators that can contribute to relevant digital commons to deliver on key features of virtual worlds.

This topic will support early demonstrations for Web 4.0 and its architectural framework, through the use of key building blocks where there is sufficient level of maturity and critical mass of commons contributors (such as in the context of the Next Generation Internet initiative).

The envisaged Web 4.0 should be powered by open and decentralised technologies enabling interoperability between platforms and networks and freedom of choice for the users. It should be developed through open source / digital commons and tackle security, scalability and sustainability at the core of the technological developments.

Applicants should define the mechanisms for contributing to and aligning with the strategic roadmap for research and innovation and the architectural Framework as it becomes available from the specific separate support action (TOPIC CSA Web 4.0 and Virtual Worlds).

Applicants should devise appropriate mechanisms for cooperating with the other projects under this action to ensure that they work in a coherent way towards the vision of an open, interoperable Web 4.0

At least one proposal in each of the area defined below will be selected. Proposals should clearly identify the area they are addressing.

Area 1: Identity management

Proposals will support and facilitate the deployment and adoption of the EU Digital Identity Wallet with the testing, community development and packaging of open-source solutions for the issuance and verification of electronic attestations and the provision of eIDAS trust services. The aim is to deliver a diversity of open-source digital solutions and services in accordance with the European digital rights and principles, empowering citizens with the freedom of choice from many secure digital identity solutions that are aligned with the EU regulations. Additionally, to foster and support enterprises to harness the benefits of the EUDI wallet and the eIDAS trust services. Examples may include the implementation of EUDI wallets for open-source operating systems, like Linux (for enterprise servers), cloud-based wallets, laptop-based wallets, open-source OS for mobile devices. Furthermore, technical solutions and services for secure and anonymous digital payments and money transfers between people, solutions for the implementation for attestation issuers and verifiers and the eIDAS trust services with a focus on the development of open-source stacks for issuers and relying parties (for issuing and verifying electronic attestations), especially as/for cloud services.

Area 2: Software Supply Chain security

Trusted frameworks are essential to keep the software supply chain secure, as demonstrated by the recent attack on XZ Utils. The aim is to strengthen the security of the software supply chain by leveraging related NGI building blocks and package solutions for example for traceability of code, collaborative trust models among contributors and users, detection of anomalous behaviour, construction of software bill of material. Use cases include developers and users of codes, DevSecOps team, corporate IT, open-source projects, industry and/or parties that need to be compliant with the Cyber Resilience Act.

Area 3: Open Hardware

Open Hardware is key for supporting trust and sovereignty as it allows users to inspect, modify, and implement freely the designs. The aim is to support the uptake of open hardware chips and tools through prototyping, productization and integration in real life cases. Proposals can address several re-usable tools and components such as controllers, processors, or network chips. Use cases include consumer devices for immersive virtual worlds, industry applications, consumer devices, smart cities.

Area 4: Alternative solutions to centralised platforms

As EU legislation places obligations on platforms, particularly focusing on gatekeepers, it is important to prioritize nurturing and enriching credible alternatives. Proposals in this area could cover integrating, testing and operation of open-source decentralised solutions offering credible alternatives to users supporting the emergence of Web 4.0 and Virtual Worlds

experience. Examples include instant messaging, application stores, or productivity groupware that should showcase virtual worlds interoperability, trust, resilience, and scalability. The focus should be made on decentralised and federated solutions based on interoperability requirements and on open standards to ensure to not only meet regulatory demands but also foster a more open, diverse, resilient, and competitive digital ecosystem.

Area 5: Web 4.0 demonstration for Virtual Worlds

Web 4.0 technologies enabling interoperability and transferability across platforms are crucial to ensure various players to contribute to virtual worlds as opposed to a mono-provider environment. This area will make use of existing open-source building blocks for ensuring trust, interoperation, interconnection, transaction, and resource access in Virtual Worlds applications and services. Proposals will aim at integrating the various building blocks, with a special focus on interoperability and will demonstrate seamless interactions (for example when browsing and searching across multiple providers) in one or two selected scenarios.

For all areas, proposals shall innovate beyond the state-of-the-art and could include development, integration, testing, deployment, uptake, and operations activities.

Proposals should encourage, when relevant, open access to data, standardisation activities, as well as an IPR regime and sustainability model ensuring lasting impact and reusability of results.

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.

Specific support for the Virtual Worlds Partnership and the Web 4.0 initiative (CSA) (Virtual Worlds Partnership)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of EUR 2,5 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting a
Indicative budget	The total indicative budget for the topic is EUR 2,5 million.
Type of Action	Coordination and Support Actions
Technology Readiness Level	N/A
Article 22.5	**NO**

Expected outcome:

The launch of a new European Partnership will help develop and promote a thriving industrial and end-user ecosystem in the EU, covering all the aspects of the virtual worlds value chain. It will also actively engage with people and society at large and provide access to a broader range of resources, including funding, expertise and technology.

This CSA should be prepared, managed and coordinated by the key stakeholders in this field. Proposal results are expected to contribute to the following outcomes:

1. The delivery of a Strategic Research and Innovation agenda (SRIA) for Web 4.0 in Europe leading to an inclusive, trustworthy, interoperable, and human-centric Web 4.0 leveraging open-source commons building blocks enabling new social and sustainability models that respect European values.

2. The delivery of a Strategic Research, Innovation and Deployment Agenda (SRIDA) for Virtual Worlds in Europe, for useful, open, interoperable, inclusive, sustainable and trustworthy virtual worlds systems and applications, ensuring Virtual worlds reflect EU values and principles.

3. Established and running European Virtual Worlds Partnership supporting the European Virtual Worlds and Web 4.0 community.

4. A strong and competitive ecosystem, with European companies playing a leading role in the adoption and acceptance, and in the development and deployment of Virtual Worlds technologies.

5. Reinforced links among initiatives in virtual worlds in Horizon Europe, Digital Europe Programme, and other programmes.

6. Widespread educational and outreach programmes

7. Increased adoption of virtual worlds that are open, interdisciplinary, safe and respect ethical values and European legal framework, including regarding privacy, security in all Member States and Associated Countries

8. Standardisation methods for virtual worlds technologies and in support of the Commission regulatory framework.

Scope:

The selected proposal should provide specific support for the coming European Virtual Worlds Partnership.

The selected proposal will:

- Support to the Virtual Worlds Partnership to develop a strong and inclusive network by strengthening the links and promoting collaboration among academia, industry, public actors and end-users, including the major industrial European sectors and all relevant stakeholders, to guarantee strong coordinated efforts toward trustworthy and human-centric virtual worlds for the economy and society. The network will also include national representatives, to link to national programmes and to foster synergies and coordination between the various European, national, public and private initiatives. Such coordination of efforts in research, innovation and expertise will be important for Europe's leadership in virtual worlds. The objective is to support the community in defining and implementing the Virtual Worlds strategy for research, innovation, and deployment, and support the Partnership in its coordination and support of the community in non-R&D tasks as well.

- Support the development and implementation of a Strategic Research, Innovation and Deployment Agenda for Virtual Worlds (SRIDA)

- Support the development of a Strategic Research and Innovation agenda (SRIA) for Web 4.0 in Europe and propose an implementation agenda of a European Web 4.0 strategy for research and innovation by defining the trajectories to drive the evolution of the internet towards Web 4.0. This should include the architectural framework

(including standards and protocols) and principles, identifying its main building blocks. The implementation strategy should also identify the technology areas where Web 4.0 and Virtual Worlds can benefit from joint developments, reuse of technologies or exchanges.

- Support the emergence of a thriving European ecosystem for Web 4.0 where developers, research teams, industry and startups can boost technological capabilities, accelerate uptake of innovative solutions, and foster a supportive business environment. This community shall be involved in the definition of the architectural framework, its main building blocks and the implementation roadmap.

- Coordinate and establish links with all relevant initiatives in Web 4.0 and Virtual Worlds in Horizon Europe, Digital Europe Programme (such as the Common European Data spaces or the Digital Twins) and other programmes (European Innovation Council, Digital Innovation Hubs, European Digital Innovation Hubs, European Digital Infrastructure Consortia, the VR/AR Industrial Coalition, etc), in view of sharing knowledge and developing synergies. Such synergies should be developed with the relevant projects through efficient mechanisms (e.g. joint task forces), organisation of joint events gathering projects, etc. In view of sharing knowledge and developing synergies, proposals shall also coordinate and establish links with relevant initiatives in this Work Programme such as references to the topics on Open Europe Stack, pilots, 3C, Web 4.0 Building blocks in priority areas (RIA).

- Closely collaborate and build synergies with other relevant European Partnerships (such as Data, AI and Robotics; Photonics, the European Blockchain Partnerships); Next Generation Internet (NGI) initiative, the European Flagships (such as Graphene), the EU supported digital twins initiatives (such as Destination Earth).

- Support and encourage the adoption of Virtual Worlds in all Member States and Associated Countries, with particular emphasis on geographical aspect and across the value chain.

- Develop and implement outreach programmes aiming at better understanding and awareness of Virtual Worlds including acceptability and trustworthiness, informing about potentialities of Virtual Worlds but also ensuring that public expectations are realistic to avoid backlash in the adoption. Such activities should target in particular the business community, with a particular focus on SMEs, as well as public administrators, and citizens at large.

- Identify ethical, legal, societal and economical aspects of virtual worlds and actions on how to tackle possible issues.

- Support to standardisation in view of boosting virtual worlds industry, creating, and guaranteeing trustworthy and ethical Virtual Worlds, by bringing stakeholders together and, when needed, organise European representation in existing or new standardisation working groups in support of the Commission regulatory framework

This topic implements the co-programmed European Partnership on Virtual Worlds and the initiative on Web 4.0.

All proposals are expected to allocate tasks to cohesion activities with the Partnership on Virtual Worlds and funded actions related to this partnership. Proposals should include activities to collaborate with projects stemming from topics relevant to virtual worlds and share or exploit results where appropriate. Proposals should also develop synergies with relevant activities in Digital Europe Programme.

International Cooperation

International cooperation in semiconductors (CSA)

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of around EUR 3 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting different amounts.
Indicative budget	The total indicative budget for the topic is EUR 3 million.
Type of Action	Coordination and Support Actions
Article 22.5	**NO**

Expected outcome:

- Evidence-based advice to the Commission and the Member States on joint actions with leading semiconductor countries (including Japan, South Korea, Taiwan, Singapore, USA, Canada, and India) in support of EU policies.

- Support to the Commission to define and implement measures aiming at strengthening the position of Europe's industry in the global semiconductor value chain.

- Factual elements (e.g. analyses of state-of-the-art, emerging technologies…) that help the Commission in assessing potential areas of cooperation.

Scope:

Within the context of semiconductor and semiconductor-based photonics (e.g. silicon photonics), the CSA will support the Commission and the Member States in the following activities:

- Preparation of a regional mapping of industrial strengths and gaps and their expected evolution;

- Identification of emerging opportunities (e.g. technologies, approaches) for cooperation with other regions;

- Definition of research areas in which international cooperation would result in tangible benefits for Europe;

- Analysis of risks to the EU's technological advancements, technological competitiveness, and access to leading-edge technology vis-à-vis international cooperation countries;

- Promotion and contribution to standardisation activities;

- Organisation of joint events contributing to the above outcomes;

- Promotion of mobility of researchers in specific topics (in cooperation with other support schemes);

- Preparation of a comparative analysis of modalities for cooperation and their applicability.

The Commission will actively engage with Member States via the European Semiconductor Board ensuring that their interests and views are taken into account. This CSA should be prepared, managed and coordinated by the key stakeholders in this field.

Links with topics in other WPs:

This topic builds on the results under the following topics:

- HORIZON-CL4-2022-DIGITAL-EMERGING-01-38: International cooperation in semiconductors (CSA)

Chips Joint Undertaking's HORIZON-Chips-2024-3-RIA: Joint call with Korea on Heterogeneous integration and neuromorphic computing technologies for future semiconductor components and systems

Specific conditions

Expected EU contribution per project	The Commission estimates that an EU contribution of EUR 1-2 million would allow these outcomes to be addressed appropriately. Nonetheless, this does not preclude submission and selection of a proposal requesting a
Indicative budget	The total indicative budget for the topic is EUR 5 million.
Type of Action	Research and Innovation Action
Technology Readiness Level	Activities are expected to start at TRL 4 and achieve TRL 6 by the end of the project – see General Annex B.
Article 22.5	**NO**

Expected outcome:

- African societies would benefit from innovative solutions on GenAI applied to key areas:

- Provide local technological companies with the technological capacity to develop targeted solutions to unlock the full potential of GenAI Digital in key areas with the primary focus on rural communities in Africa.

Scope:

Generative AI (GenAI) holds the potential of creating in Africa a rich ecosystem of transformative solutions and practical applications addressing the specific societal challenges and opportunities most of the countries are facing.

The proposals should address one or more of the following topics:

- Agriculture optimisation: GenAI can analyse satellite imagery and sensor data to monitor state of crops, soil conditions, and weather patterns, enabling farmers to boost crop yields and enhance food security through sophisticated predictive analytics and efficient resource management like water and pesticides. This is crucial to mitigate climate change and poor irrigation infrastructures in some areas of Africa.

- Healthcare: GenAI can diagnose diseases from medical images and patient data, enhancing healthcare in remote areas; forecast disease outbreaks and aid in preventive

planning, and with the help of chatbots and virtual assistants can offer medical advice and connect patients with doctors, expanding telemedicine services, making healthcare more accessible to remote populations.

- Infrastructure and urban planning: GenAI optimises energy usage, integrates renewables, and ensures efficient distribution, while managing water and waste effectively for sustainability, and enhancing safety with real-time incident detection. It also provides support for reconstruction following natural or human-made disasters. This is vital for some African communities with scarce natural resources like water and facing high temperatures by using Urban Digital Twins.

- Digital Skills and learning: Generative AI can personalize learning paths, create multilingual educational content, and offer on-demand virtual tutoring, benefiting rural communities with low resources and fully relying on mobile phones to access online services. Additionally, adaptive learning platforms can use data analytics to tailor teaching, while engineers craft queries to help AI models understand local languages and nuances to set up conversational chatbots for local communities.

The proposals will approach these objectives by:

- Developing and integrating generative Artificial Intelligence models and algorithms specifically adapted for one or several of the abovementioned key areas.

- Involving and supporting start-ups in Africa to create innovative solutions to uniquely African challenges in those areas based on GenAI.

Links with topics in other WPs:

Procurement projects in AI for public good, in the areas of health, digital twin for reconstruction, emergency response and electric grid optimisation.

AI for Public Good 1: Innovative cancer imaging services AI-based for breast and prostate diagnosis

As part of the cooperation with the US on AI for Public Good, in the area of health innovative services are to be implemented for cancer imaging detection relying on AI algorithms that later can be offered to hospitals and clinical centers in need of advanced technologies.

Technical teams on both sides will train, enhance and optimise existing AI models and algorithms for breast and prostate cancer diagnosis using images. The training will utilise generative AI and machine learning as appropriate based both on synthetic and real data from clinical sources from the US and EU.

The set of innovative services to be procured through domain experts by the EC for phases II (development), III (testing)

- Train, enhance and optimise existing AI models and algorithms for breast and prostate cancer diagnosis using images. The training will utilise generative AI and machine learning as appropriate based both on synthetic and real data from clinical sources from the US and EU. Sources of, mainly magnetic resonance, data images will be identified and organised according to ethical and privacy requirements and equipped with efficient and secure access mechanisms.

- Validation of required level of enhanced accuracy of models will be validated, prior to their testing in real trials. Trials will be undertaken for each use case (breast and prostate cancer) in countries in need, through clinical centres, e.g. in Kenya and South Africa (tbc) and in trials in locations in Asia (US proposal).

- Following the trials, the experts will plan and initiative the steps towards regulatory approval of the algorithms, for use in real life scenarios.

- The enhanced AI models and guidelines to their use in diagnosis will be delivered as open access to EU and US researchers, as well as to stakeholders from other world regions (in particular to low-to-middle income countries).

- The teams should also assess the potential to provide the AI models and their diagnosis guidelines and training possibly using virtual and remote learning, as a service to countries in need through e.g. hosting in high computing facilities.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: First quarter of 2025

Indicative budget: EUR 2.4 million

AI for Public Good 2: Innovative services AI-based for emergency response and crisis management

As part of the cooperation with the US on AI for Public Good in the area of emergency response, innovative solutions and services are to be implemented to face natural disasters such as wildfires and flooding. This will be done through a combination of advanced technologies including AI, geographic information systems, and real-time data analytics empowering emergency responders to anticipate, optimize, and track resource allocation, coordinate response efforts more effectively. The goal is to implement a multihazard **open, modular, multi-hazard platform** that harnesses the potential of artificial intelligence (AI) to significantly enhance emergency response capabilities during natural disasters, supporting them with accurate data. The ecosystem will leverage existing global, national and regional systems like the Global Wildfire Information System ([GWIS)](GWIS) and National Emergency Response Information System [NERIS]).

The set of innovative service to be procured by the EC for phases II (development), III (testing)

- Development of the platform and integrating the existing Global Wildfire Information System (GWIS) that already covers the entire planet. Potentially integration of other US-based systems (Calfire, Missoula science lab...).

- Host the platform in cloud-based servers.

- Deployment in several countries in Latin America (mainly Central America, the Carabeen and Colombia) and others suggested with the US.

- Support for the EU (DG ECHO) to use the platform as part of the Union Civil Protection Mechanism (UCPM).

- Assess the potential to provide the platform as a service, hosted in high computing facilities in order offer emergency response capabilities to countries in need at broader scale. Prepare the scaling-up and hosting.

- Design and develop of the multihazard platform for disaster 2: floods.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: First quarter of 2025

Indicative budget: EUR 2 million

AI for Public Good 3: Innovative services AI-based for urban reconstruction

As part of the cooperation with the US on AI for Public Good, in the area of reconstructive innovative services are to be implemented to support urban reconstruction planning relying on AI algorithms.

The set of innovative services to be procured by the EC for phases II (development), III (testing) are:

- Technical research teams from EU and the US will identify data sources and create a dataset containing 3D virtual replicas of buildings in cities all over the world (excluding replicas from the EU and the US which are already under development).

- The teams will organise the data and make it accessible according to agreed security, privacy etc. requirements and develop and train supporting AI algorithms for trustworthy, transparent and cost-efficient reconstruction projects.

- The virtual replicas and the AI algorithms will be integrated into a Geographical Information System (GIS) platform for a complete offering of digital twin and AI-algorithm-based reconstruction services.

- The teams should also assess the potential to provide the GIS platform, hosted in high computing facilities in order offer the services to countries in need at broader scale.

- Design and develop the production version of a Digital Twin for reconstruction based on pilots conducted in Phase I.

- Deploy the solutions in several counties in need, like Ukraine.

The teams should also assess the potential to provide the platform, hosted in high computing facilities in order offer the services to countries in need at broader scale.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: First quarter of 2025

Indicative budget: EUR 2 million

AI for Public Good 4: Innovative services AI-based for electric grid optimisation

As part of the cooperation with the US on AI for Public Good in the area of electric optimization, innovative solutions and services are to be implementing enabling dynamically the integration of renewable energy sources to meet increasingly fluctuating demands. The solutions will rely on AI to enhance energy efficiency and promote optimal usage, contributing to a greener society.

The set of innovative services to be procured through domain experts by the EU for phases II (development), III (testing) are:

- Finish design and development of edge-oriented AI-based flexibility tools. It will be done combining different modeling activities already available and present scenarios of flexibility over the long-term, providing an assessment tool.

- Running laboratory simulations for verification of the proposed mechanism of data exchanges and complex systems simulation.

- Concept testing and validation of tools both in the lab and in the field, prior to testing in EU locations (e.g. Rome, Denmark, Portugal).

- Deployment in third countries in need e.g. Peru (Lima).

- The teams should also assess the potential to provide the platform, hosted in high computing facilities in order offer the services to countries in need at broader scale.

Form of Funding: Procurement

Type of Action: Public procurement

Indicative timetable: First quarter of 2025

Indicative budget: EUR 3 million