Horizon Europe WP 2021-2022, aggregation of all AI related calls

Contents

Research Infrastructures cluster

Topics summary

Topic name	Deadline	Funding per project
HORIZON-INFRA-2021-EOSC-01-04: Innovative and customizable services for EOSC	23.9.21	€3-5M
HORIZON-INFRA-2021-SERV-01-06: Enabling research infrastructure services for better use of imaging data to address challenges in thematic research areas	23.9.21	€2.5-4.5M
HORIZON-INFRA-2021-TECH-01-01: Interdisciplinary digital twins for modelling and simulating complex phenomena at the service of research infrastructure communities	23.9.21	€9-12M
HORIZON-INFRA-2021-EOSC-01-01: Supporting an EOSC-ready digitally skilled workforce	23.9.21	€7M

Essentials in a nutshell:

- Circa 4 projects are expected to be funded, for €3-5M each.
- Submission deadline: 23/09/21.

Expected Outcome:

Project results are expected to contribute to all the following expected outcomes:

- increased service offer and capabilities beyond the present landscape in addressing the current and anticipated needs of the research community at large;
- increased availability of (pre)operational services that can be customised and integrated in the existing workflows of researchers across different disciplines, facilitating the cross-disciplinary collaboration, reducing the time to results and increasing productivity.

Scope:

The aim is to provide researchers with a set of highly innovative new services that would exploit, in a structural way, cloud-based EOSC technologies and European compute and data management capacities. Proposals should cover the following activities:

- Development and improvement of existing pre-operational software, tools and open source services, aiming to be integrated to the service-based architecture offered through the EOSC;
- Iterative and inclusive development in close cooperation/co-design with the relevant user communities;
- Improving the TRL of the components and adding new features based on requirements from research communities, use of open source software and tools for wide availability and uptake;

The application range of these services for data intensive science is wide (e.g. automated extraction of information from scientific literature, experimentation, optimising experimental design, collection and analysis of heterogeneous and/or large-scale data, validation of data quality, repeatability and reproducibility in science, discovery and on-demand provisioning of open science resources and their reuse; storing, sharing and reusing research data, enabling secure data use and transactions, workflow management) making use of various enabling technologies, e.g. artificial intelligence and machine learning, natural language processing, automation, simulation, big data analytics or blockchain. To be robust, customizable and scalable,

all developments should be tested against 2-3 real life use cases from a variety of scientific domains. The projects should cooperate with other relevant and related projects and e-Infrastructures and large user communities. Joint use cases and testing across individual project boundaries are encouraged. The services should be integrated in the EOSC core service platform[1] and proposals should include sufficient provisions to address the integration, including, appropriate IPR and licence agreements. The resources that the services will offer should be clearly identified in the proposals. The sustainability model for the long-term availability of services can rely on EOSC. Participation of industry players, including SMEs, is recommended for both the development and further exploitation of the project results. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-INFRA-2021-SERV-01-06: Enabling research infrastructure services for better use of imaging data to address challenges in thematic research areas

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €2.5-4.5M each.
- Submission deadline: 23/09/21.

Expected Outcome:

Project results are expected to contribute to some of the following expected outcomes:
- improved acquisition, quality, interoperability and analysis of imaging data from different disciplines (e.g.: health & food, climate and environmental research, digital transformation);
- wider use of image analysis services based on AI in different scientific areas.

Scope:

The availability of high-performance image analysis tools, including those based on AI, through the provision of RI services, has a great potential to improve the use of image data for research purposes. These services enable better use of imaging data by aligning data formats, ensuring better data quality and noise reduction, improving interoperability, applying advanced data analysis, interpretation and potentially visualisation, as well as by integrating imaging data with other data sets of different types. Use of artificial intelligence as enabler for better exploitation of data sets for research queries will be an important contribution from research infrastructures to the Commission's AI strategy proposed in the Commission's White Paper On Artificial

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[1] See Public Procurement 1. Delivering the EOSC core infrastructure and services, under Other Actions

Intelligence - A European approach to excellence and trust (COM(2020) 65 final). Proposals under this topic bring together several complementary and interdisciplinary RIs to provide trans-national access (inperson, when the user visits the infrastructure to make use of it or remote access) and/or virtual access to integrated and customised RI services for challenge-driven research and innovation. Access also includes ad hoc users' training and scientific and technical support. Harmonisation, customisation and virtualisation of RI services will also be supported. Successful proposals will offer services, including AI-based services for improved analysis of imaging data in different thematic areas (e.g. environmental monitoring, life sciences, chemistry, physics,...). Appropriate links and complementarities must be ensured with the existing AI4EU platform[2] and relevant activities under Pillar II of Horizon Europe. AI-based tools and services will make use of the EOSC commons as working environment where these tools, services and relevant data sets will be made findable and accessible for use, thus making EOSC operational for the delivery of research infrastructure data services for thematic research challenges.

HORIZON-INFRA-2021-TECH-01-01: Interdisciplinary digital twins for modelling and simulating complex phenomena at the service of research infrastructure communities

Essentials in a nutshell:

- Circa 4 projects are expected to be funded, for €9-12M each.
- Submission deadline: 23/09/21.

Expected Outcome:

Research infrastructures are not only thematically very diverse but also in terms of size, ranging from the long tail of science, often characterised by individual laboratories or small groups of researchers, to large, "big science" collaborations. Scientists and researchers, including the long-tail of science, lack capabilities enabling complex simulations, combining simulations with observations and dealing with very large volumes of diverse data from various and distributed sources. The availability of high-quality Digital Twins[3] across a wide range of thematic applications could fill this gap. Project results are expected to contribute to all the following expected outcomes:

- availability of a pre-operational prototype of an interdisciplinary Digital Twin, using a combination of the latest digital technologies, relevant to addressing challenges where multi-disciplinarity is the defining element of complexity;

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[2] https://www.ai4eu.eu/
[3] A Digital Twin is defined as a digital replica of a living or a non-living physical entity.

- availability of latest modelling and prediction technologies in a number of different areas widely serving research communities and supporting interoperability of data and software, integration and collaboration across different scientific domains, disciplines and across the different research infrastructures involved;

- a robust framework enabling Researchers to ensure the quality, reliability, verifiability of the data, information and outputs of such Digital Twins and to exploit to the maximum the existing and new data made available through the Common European Data Spaces and the European Open Science Cloud.

Scope:

Actions should develop digital twins that provide advanced modelling, simulation and prediction capabilities to RIs and their research communities through a convergent use of advanced digital technologies such as high performance computing, software, AI methods and big data analytics. With the advent of big data analytics and supercomputing, AI methods have the potential to allow exploiting the full potential of simulations and observations at significantly enhanced scales and to substantially increase the value, which can be extracted from investments into digital infrastructures and hardware. This fusion of models and real-time data is of crucial importance in many scientific areas, which – due to the complexity of the underlying phenomena – are heavily dependent on converging traditional modelling with the increasing amount of real-time data in order to arrive at more accurate present-state assessments and predictions (e.g. high energy physics, astrophysics, environmental research, security applications, materials research, resource efficiency, econometrics, population dynamics and related global changes). Achieving this will require a co-design approach with user communities. Target should be the development of more integrated systems and a consistent set of standard methods and protocols in the areas of (a) model and data fusion for optimal synergy between observations and models, including provisions to include information from the entire digital continuum (from smart sensors, IoT, big data to citizen science type of information, high-performance computing; and (b) visualisation and artificial intelligence based knowledge generation from spatio-temporal information.

Given the emerging nature of the Digital Twin concept as applied to more complex phenomena, work should also cover the development of quality measures and trust, development of standard quality mapping and indicators for appropriately communicating differences in qualities of inputs and outputs from digital twins, addressing issues such as data and model pedigree, accuracy and lack of knowledge. In addition to addressing pertinent priority areas in an interdisciplinary manner, proposals should also demonstrate the following:

- Deliver a breakthrough in terms of accuracy and realism
- Optimally fuse observations and models

- Integrate downstream sectors at the source of data production (adjacent science sectors)
- Include a rigorous handling of quality and confidence of information
- Develop capabilities of the new digital continuum enabling research communities to continuously learn and update themselves from data and information originating from different sources

Work under this topic should reach a sufficiently high TRL level (6-7) to be considered for integration into operational activities of for example existing research infrastructures, the EOSC platform, and undertaken in related fields. Work under this topic should link to relevant actions, when appropriate, under Digital Europe Programme (e.g. Destination Earth). In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-INFRA-2021-EOSC-01-01: Supporting an EOSC-ready digitally skilled workforce

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €7M.
- Submission deadline: 23/09/21.

Expected Outcome:

Project results are expected to contribute to all the following expected outcomes:

- availability of highly and appropriately skilled professionals enabling the practice of Open Science with adequate knowledge of standards, applications and tools and best practices for delivering, managing, re-using, sharing and analysing FAIR data, as well as other digital research objects;
- researchers are able to transform the way they carry out research and exploit research outputs, leading to better quality and more productivity of research;
- contribute to the Horizon Europe EOSC Partnership.

Scope:

Development of new support material, curricula and learning pathways for researchers, data curators, and data stewards and new types of professionals. To ensure an efficient uptake and exploitation of data by Public Authorities (e.g. for evidence-based policy making), policy makers should also become skilled in data acquisition, management and analysis. Proposals should therefore cover the following activities:

- Engage with the relevant stakeholders at national and institutional level in order to cocreate, promote, broker and ensure the recognition of digital career profiles specifically related to Open Science. This includes the development of quality assurance mechanisms for professional training and qualifications.
- Promote existing and develop new curricula (at undergraduate, PhD and professional level) that meet the demands of open and data-intensive science, and the establishment of advanced learning environments, in order to train the next generation of scientists, librarians and infrastructure professionals on topics such as the management and integration of diverse data flows and artificial intelligence for FAIR data management.
- Foster the development of a distributed pan-European user support network, supporting the collaboration of existing networks of competence and data curation centres, in order to provide expertise on storing, sharing and reusing digital outputs, as well as on the onboarding of EOSC services and the provision of open science resources.

Health cluster

Topics summary

Topic name	Deadline	Funding per project
HORIZON-HLTH-2022-STAYHLTH-01-04-two-stage: Trustworthy artificial intelligence (AI) tools to predict the risk of chronic non-communicable diseases and/or their progression	1.2.22 (First Stage) 6.9.22 (Second Stage)	€6M
HORIZON-HLTH-2021-DISEASE-04-04: Clinical validation of artificial intelligence (AI) solutions for treatment and care	21.9.21	€10M
HORIZON-HLTH-2021-TOOL-06-03: Innovative tools for use and re-use of health data (in particular of electronic health records and/or patient registries)	21.9.21	€8M
HORIZON-HLTH-2022-IND-13-02: Scaling up multi-party computation, data anonymisation techniques, and synthetic data generation	21.4.22	€3M
HORIZON-HLTH-2022-DISEASE-06-02-two-stage: Pre-clinical development of the next generation of immunotherapies for diseases or disorders with unmet medical needs	1.2.22 (First Stage) 6.9.22 (Second Stage)	€6M
HORIZON-HLTH-2021-ENVHLTH-02-03: Health impacts of climate change, costs and benefits of action and inaction	21.9.21	€6M
HORIZON-HLTH-2021-CARE-05-02: : Data-driven decision-support tools for better health care delivery and policy-making with a focus on cancer	21.9.21	€10M
HORIZON-HLTH-2022-IND-13-01: Enhancing cybersecurity of connected medical devices	21.4.22	€6M

HORIZON-HLTH-2022-STAYHLTH-01-04-two-stage: Trustworthy artificial intelligence (AI) tools to predict the risk of chronic non-communicable diseases and/or their progression

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €6M
- Submission deadline: first stage – 1.2.22, second stage – 6.9.22

Expected Outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 1 "Staying healthy in a rapidly changing society". To that end, proposals under this topic should aim for delivering results that are directed, tailored towards and contributing to all of the following expected outcomes.

- Clinicians, medical professionals and citizens have access to and use validated AI tools for disease risk assessment. Hence, citizens are better informed for managing their own health.
- Health care professionals utilise robust, trustworthy and privacy-preserving AI tools that help them to assess and predict the risk for and/or progression of chronic noncommunicable diseases. Hence, citizens benefit from improved health outcomes.
- Health care professionals develop evidence-based recommendations and guidelines for the implementation of AI-based personalised prevention strategies. Hence, citizens benefit from optimized health care measures superior to the standard-of-care.
- Health care professionals employ quantitative indicators in order to identify and followup on individuals with high risk for the development and/or risk for the progression of chronic non-communicable diseases.

Scope:

It is widely recognised that health systems must put more emphasis on prevention and adopt a person-centred approach. Artificial intelligence (AI) along with the increased availability of health data hold great potential to pave the way for personalised prevention and enable progress towards risk prediction and early detection of chronic non-communicable diseases. This topic will support multidisciplinary research, build on broad stakeholder engagement and support proposals developing novel robust and trustworthy[4] AI tools to enable timely personalised prevention approaches for chronic non-communicable diseases/disorders. The topic does not

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[4] Ethics Guidelines for Trustworthy AI, published by the European Commission's High Level Expert Group on Artificial Intelligence, https://ec.europa.eu/futurium/en/ai-allianceconsultation/guidelines#Top.

exclude any diseases/disorders. Proposals are expected to develop and test AI tools for assessing and predicting the risk of developing a disease and/or the risk of disease progression once it is diagnosed, taking into account the individuals' (or groups) genotypes, phenotypes, life-style, occupational/environmental stressors and/or socio-economic and behavioural characteristics, as necessary. Sex and gender aspects should be considered, wherever relevant. The AI tools may include a broad range of technological solutions on their own and/or in combination with other relevant state-of-the-art technologies (i.e. AI algorithms, mobile apps and sensors, robotics, e-health tools, telemedicine etc.) Proposals should implement proof-of-concept studies to test and validate the performance of their AI tools in the real-world setting and compare their performance to the established practice.

The applicants should ensure that the AI tools developed are driven by relevant endusers/citizens/health care professionals needs. Therefore, the proposals are expected to introduce concrete measures for the involvement of the end-users throughout the AI development process and not only in the last phases of development. SME(s) participation is encouraged with the aim to strengthen the scientific and technological basis of SME(s) and valorise their innovations for the people's benefit.

Proposals should address all of the following:

- Leverage existing high-quality health-relevant data from multiple sources (i.e. cohorts, electronic health records and registries, taking into account the individual's genotypic/phenotypic, medical, life-style, socio-economic, behavioural data etc.) and/or generation of new high-quality health data necessary for the rigorous development of the AI disease-risk tools.
- Develop the adequate performance metrics to assess the technical robustness of the developed AI tools for risk assessment of disease and/or disease progression and in particular their accuracy, reliability, reproducibility and generalisability. Proposals should assess the possible inherent bias introduced to the AI tools originating from the data quality used for their development.
- Develop the criteria to assess the effectiveness of the AI tools for disease risk assessment in terms of improving health outcomes and enabling personalised prevention strategies.
- Implement proof of concept and/or feasibility studies to validate the AI tools for risk assessment of disease and/or disease progression in a relevant end-users environment and/or real-world setting and assess their performance in comparison to the standard-of care.

Proposals should adhere to the FAIR24 data principles and apply good practices for GDPRcompliant personal data protection. Proposals are encouraged to implement international standards and best practices used in the development of AI solutions. Integration of ethics and

health humanities perspectives to ensure an ethical approach to the development of AI solutions. In relation to the use and interpretation of data, special attention should be paid to systematically assess for gender and ethnic bias and/or discrimination when developing and using data-driven AI tools. To ensure citizens' trust, wide uptake by user communities and scalability of the solutions across clinical contexts, actions should promote the highest standards of transparency and openness of the AI tool, going well beyond documentation and extending to aspects such as assumptions, architecture, code and underlying data. Applicants are highly encouraged to deliver a plan for the regulatory acceptability of their technologies and to interact at an early stage with the regulatory bodies, whenever relevant. All projects funded under this topic are strongly encouraged to participate in networking and joint activities, as appropriate. These networking and joint activities could, for example, involve the participation in joint workshops, the exchange of knowledge, the development and adoption of best practices, or joint communication activities. This could also involve networking and joint activities with projects funded under other clusters and pillars of Horizon Europe, or other EU programmes, as appropriate. Therefore, proposals are expected to include a budget for the attendance to regular joint meetings and may consider to cover the costs of any other potential joint activities without the prerequisite to detail concrete joint activities at this stage. The details of these joint activities will be defined during the grant agreement preparation phase. In this regard, the Commission may take on the role of facilitator for networking and exchanges, including with relevant stakeholders, if appropriate.

HORIZON-HLTH-2021-DISEASE-04-04: Clinical validation of artificial intelligence (AI) solutions for treatment and care

Essentials in a nutshell:

- Circa 6 projects are expected to be funded, for €10M each.
- Submission deadline: 21/09/21.

Expected Outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 3 "Tackling diseases and reducing disease burden". To that end, proposals under this topic should aim for delivering results that are directed, tailored towards and contributing to all of the following expected outcomes:

- Health care professionals employ safer and evidence-based clinical decision support systems for affordable treatment, including home-based care.
- Health care professionals better predict patients' (long-term) response, including adverse side effects of a specific personalised treatment.

- Patients and carers have access to disease-specific communication packages informing about a disease and the proposed treatment.
- Clinical guidelines are enhanced thanks to novel, clinically validated and (cost-) effective AI solutions.

Scope:

Applying trustworthy-AI101[5] in healthcare contexts generate a multitude of benefits, including more effective disease management by optimised personalised treatments and assessment of health outcomes. Based on existing (pre)clinical evidence, proposals should focus on implementing clinical studies to validate AI-based solutions comparing their benefits versus standard-of-care treatments in non-communicable diseases. Proposals should pay special attention to the usability, performance and safety of the AI-based solutions developed, and above all to their clinical evaluation and (cost-)effectiveness in view of their inclusion into current clinical guidelines for personalised treatments following current EU regulatory framework. Proposals should address all of the following:

- Supporting the clinical development, testing and validation of AI-assisted treatment and care options, hereby assisting in clinical decision-making;
- Timely end-user inclusion (e.g. patient, caregiver and health care professional) along the clinical development of the AI-based solutions and the clinical validation process, considering the potential of social innovation approaches to support inclusion and dialogue between patients, carers and health care professionals;
- Enhancing accurate prognosis for and response to a specific personalised treatment, hereby providing a solid risk assessment (e.g. potential adverse events, side effects, expected treatment compliance and adherence over the time compared to standard care);
- Inclusion of sex and gender aspects, age, socio-economic, lifestyle and behavioural factors and other social determinants of health, as soon as possible considering also early stages/phases of development;
- Assessing potential manual or automated biases for large uptake;
- Integration of an extensive information and communication package about AI-assisted treatment options;, highlighting their relevance for the patients and carers;
- Measuring the (cost-)effectiveness of AI-assisted development of therapeutic strategies and its implementation in clinical practice.

Proposals should describe a pathway for establishing standard operating procedures for the integration of AI in health care (e.g. for supporting clinical decision-making in treatment and

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[5] High Level Group on Artificial Intelligence, set up by the European Commission, Ethics Guidelines for Trustworthy AI, document made public on 8 April 2019.

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care). Proposals are encouraged to consider multidisciplinary approaches and allow for intersectoral representation. Proposals have to ensure that resulting data comply with the FAIR[6] principles and data generated by the AI-based solutions are in line with established international standards. Integration of ethics and health humanities perspectives are essential to ensure an ethical approach to the development of robust, fair and trustworthy AI solutions in health care, taking into account underrepresented patient populations. In relation to the use and interpretation of data, special attention should be paid to systematic discrimination or bias (e.g. due to gender or ethnicity) when developing and using AI solutions. Proposals should also focus on traceability, transparency, and auditability of AI algorithms in health. The international perspective should be taken into account, preferably through international collaboration, to ensure the comprehensiveness, interoperability and transferability of the developed solutions. Where relevant, applicants are highly encouraged to deliver a plan for the regulatory acceptability of their technologies and to interact at an early stage with the relevant regulatory bodies. SME(s) participation is encouraged.

HORIZON-HLTH-2021-TOOL-06-03: Innovative tools for use and re-use of health data (in particular of electronic health records and/or patient registries)

Essentials in a nutshell:

- Circa 4 projects are expected to be funded, for €8M each.
- Submission deadline: 21/09/21.

Expected Outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 5 "Unlocking the full potential of new tools, technologies and digital solutions for a healthy society". To that end, proposals under this topic should aim for delivering results that are directed, tailored and contributing to all of the following expected outcomes:

- Novel solutions improve quality, ensure interoperability and enable re-use of health data, data analytics and metadata from different repositories across countries by health professionals, researchers and health authorities, in compliance with FAIR data7 management principles as well as national and EU legal and ethical requirements (in particular with regard to personal data protection).

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[6] FAIR data are data, which meet principles of findability, accessibility, interoperability, and reusability.
[7] FAIR data are data, which meet principles of findability, accessibility, interoperability, and reusability.

- Health professionals, researchers and health authorities make effective use of tools enabling them to exploit unstructured and heterogeneous data from different sources to improve the delivery of care and advance health research.
- Increased use and valorisation of health data by patients, researchers and clinicians thanks to better data portability due to the standardization of meta knowledge (meta data, ontologies and reference repositories) and clinical data, especially health data coming from different clinical services and sites, and/or from multiple countries.
- Health care professionals use more efficient and cost-effective health care procedures and workflows that contribute to improved disease prevention, early detection/diagnosis and more effective treatment.

Scope:

Health data exists in many forms and multiple fragmented repositories; there is still significant room for improvement in the way both structured and unstructured health data is stored, analysed and interpreted. Sharing and analysing data from multiple countries in a safe and legally compliant manner (in particular with regard to personal data protection) remains a challenge. Powerful analytic tools are already helping providers to use structured data in increasingly impactful ways. On the other hand, the heterogeneity, diversity of sources, quality of data and various representations of unstructured data in health care increase the number of challenges as compared to structured data.

Advances in AI and machine learning, however, have the potential to transform the way clinicians, providers and researchers use unstructured data. Furthermore, developing data interoperability standards, trust and harmonization of GDPR's interpretation across the EU for the sharing and processing of personal health data will support establishing a sound health data culture in view of the European Health Data Space. Proposals should address all of the following aspects:

- Developing robust novel solutions compliant with legal requirements (in particular concerning personal data protection) that will improve the quality, interoperability, machine-readability and re-use of health data and metadata in compliance with FAIR data management principles, making these data more accessible to clinicians, researchers and citizens. The focus should be on data in electronic health records (EHRs) and/or patient registries, taking into account the Commission Recommendation on a European Electronic Health Record exchange format.[8]

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[8] https://digital-strategy.ec.europa.eu/en/library/recommendation-european-electronic-health-record-exchange-format.

- Developing innovative natural language processing tools, including computational semantics, ontologies, text mining, associated machine learning and deep learning, to improve accessibility, interoperability, translation, transcription, and analysis of health data (e.g. to predict risks). Tools should extract health information from unstructured data in different clinical and medical sources, and bring that data into EHRs/patient registries in a structured form. The innovative solutions should also address missing data in EHRs and/or patient registries and their related metadata, to reduce bias and improve the quality of conclusions.
- Developing and piloting AI-powered virtual assistants that will utilise the tools and solutions developed (as mentioned above) in order to demonstrate improved usability of health data for end-users.

Proposals are expected to build on and contribute to existing European and international data standards, specifications and schemas for health data. The use of open standards should be considered and interactions with relevant ongoing research infrastructure efforts are encouraged. Applicants should focus on health data coming from a number of EU Member States and EEA countries, constituting as much as possible a representative sample of the European healthcare landscape, so as to contribute to the work on the creation of the European Health Data Space.

To guarantee their adoption, the developed solutions should be quick and easy to use by researchers and clinicians. Therefore active involvement of end-users from the onset is encouraged. In particular, patient advocacy groups and citizens should be involved to ensure adequate consideration of diverse patient needs, with respect to their gender, ethnicity, age, ability, and socio-economic background, to underpin acceptance by patients and other data subjects. SMEs participation is also encouraged.

The proposals should duly take into account requirements stipulated in the relevant European regulations (Data protection, in vitro diagnostics and medical devices) and must meet appropriate ethical standards.

Essentials in a nutshell:

- Circa 5 projects are expected to be funded, for €3M each.
- Submission deadline: 21.4.22

Expected Outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 6 "Maintaining an innovative, sustainable and globally competitive health industry". To that end, proposals under this topic should aim for delivering results that are directed, tailored towards and contributing to all of the following expected outcomes:

- The EU contributes strongly to global standards for health data through enhancement of common European standards for health data (including medical imaging data) by researchers and innovators. Researchers and innovators contribute to GDPR compliant guidelines and rules for data anonymisation.
- Innovators have access to advanced secure data processing tools to test and develop robust data-driven digital solutions and services in response to the needs of researchers, clinicians and health systems at large.
- Cross-border health data hubs further facilitate the innovation process by providing secure, trustable testing environments for innovators.
- Clinicians, patients and individuals use a larger variety of high-quality data tools and services for wellbeing, prevention, diagnosis, treatment and follow-up of care.
- Researchers and innovators have more opportunities for testing and developing GDPR compliant data driven solutions based on actual needs of the health care environments.

Scope:

It is essential to speed up and facilitate innovations in the field of data-driven tools and services for wellbeing, prevention, diagnosis, treatment and follow-up of care, among others. However, limited access by developers to health data and secure testing environments hinder the development of innovative data-driven digital health products and services.

Therefore, the proposals are expected to scale up multi-party computation, data anonymisation techniques and synthetic data generation. To ensure privacy, the data analytics should be conducted in a distributed way among processors that grant third parties access to analysis

outcomes but not to the underlying data. The developers should have access to distributed testing data sources and cloud and computing resources at large scale, with a view to improving the speed and robustness of multi-party computation solutions for innovators. The aim is to allow secure GDPR-compliant data processing for research, and clinical purposes.

The proposals should consider the use of synthetic, i.e. artificially generated, data as they allow researchers and developers to test, verify and fine-tune algorithms in large-scale data experimentations without re-identifiable personal data.

In addition, the proposed anonymisation techniques will have to be sophisticated and robust enough to tackle the challenge of anonymised data sets that still make it possible to trace back to individuals.

The proposals are expected to foster the development of secure, interoperable, transparent - and therefore trustable - cross-border health data hubs that can facilitate the provision of the required testing environments for innovators. This will support the uptake of new data tools, technologies and digital solutions for health care.

To this end, integration of national/regional health data hubs/repositories/research infrastructures is appropriate to achieve the scope of the topic. The proposals are expected to address all of the following areas:

- Consolidate and scale up multi-party computation and data anonymisation techniques and synthetic data generation to support health technology providers, in particular SMEs.
- Support the development of innovative unbiased AI based and distributed tools, technologies and digital solutions for the benefit of researchers, patients and providers of health services, while maintaining a high level of data privacy.
- Advance the state-of-the-art of de-identification techniques, to tackle the challenge of anonymised datasets that can be traced back to individuals.
- Develop innovative anonymisation techniques demonstrating that effective data quality and usefulness can be preserved without compromising privacy.
- Explore and develop further the techniques of creating synthetic data, also dynamically on demand for specific use cases.
- Widen the basis for GDPR-compliant research and innovation on health data.
- Ensure wide uptake and scalability of the methodologies and tools developed, promote high standards of transparency and openness, going well beyond documentation and extending to aspects such as assumptions, architecture, code and any underlying data.

Essentials in a nutshell:

- Circa 10 projects are expected to be funded, for €6M each
- Submission deadline: first stage – 1.2.22, second stage – 6.9.22

Expected Outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 3 "Tackling diseases and reducing disease burden". To that end, proposals under this topic should aim for delivering results that are directed, tailored towards and contributing to some of the following expected outcomes:

- The scientific and clinical communities make effective use of the pre-clinical validation of new immunotherapies for high burden diseases or disorders with unmet medical needs.
- The scientific and clinical communities have access to new knowledge allowing for a better understanding of the mode of action of the next generation of immunotherapies and/or combinatorial treatments, which enables further development and optimisation of treatments.
- The scientific and clinical communities have access to and use new personalized models (in vitro and in vivo) for high burden diseases or disorders as well as protocols for the next generation of immunotherapies.
- Health care professionals have access to and use new evidence-based safety and efficacy guidelines for immunotherapies. Proof-of-clinical concept, when applicable, as single or combinatorial treatment, should be compared to existing approaches.

Scope:

Immunotherapy is defined as a treatment able to stimulate or restore the ability of the immune (defence) system to fight infection, disease or disorder. It has proved to be a valuable medical treatment notably when preventive interventions are not available. Passive and active immunotherapies (such as antibody-based, RNA-based and cell-based therapies, respectively) are covered by this topic, which is aiming at the pre-clinical to first-in human development of next generation immunotherapies for unmet needs.

Proposals should build on existing knowledge in the field, when available, in order to save time and to avoid spilling resources, and could build on the knowledge of the interaction between the

immune system (innate and adaptive arms) and the microbiota, or take advantage of key enabling technologies such as biotechnology and nanotechnology, advanced manufacturing, imaging, 5G, internet of things, artificial intelligence and existing databases.

The next generation of immunotherapies are needed in order to improve and diversify the capabilities of health care for several communicable and non-communicable diseases[9] that cannot be effectively tackled with the currently available treatments. Proposals are expected to address some of the following research gaps for the development of the next generation of effective and safe immunotherapies:

- Preclinical development and study of new immunotherapeutic agents in vitro and in relevant animal model(s) of the disease(s). This includes understanding of the therapy's agent(s) mode of action, its toxicity, the development of related potency assay(s), and its/their validation in vitro and in vivo. A robust regulatory and Health Technology Assessment (HTA) strategy should be in place at the start of the proposal.
- Off-the-shelf therapies, including the cell-based therapies, will be considered as assets during the evaluation.
- Proposals could include proof-of-concept (PoC)/first-in-human studies for testing the new therapies, with a clear regulatory and clinical pathway10 and should address as appropriate the therapy-related potential for adverse side effects. PoC and clinical studies in humans should take sex, gender, age and socio-economic factors into account, where relevant. Phase II studies or later phase trials will not be supported.
- Development of a standardised framework for assays and data usage to enable a robust assessment of the safety and efficacy.
- In case treatments are already available for the proposed targeted disease(s), a justification of the need for development of a new immunotherapy treatment is requested.
- The proposed action should include a pathway of the necessary steps to ensure sustainable therapeutic agent production (considering intellectual property management if relevant) and uptake by health systems and rapid access to patients.

Projects may consider the use of the nanobiotechnology infrastructure platform of the European Commission's Joint Research Centre, in particular for the accurate physicochemical characterization of therapeutic proteins and antibodies.

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[9] Excluded from the scope are the preventive vaccines, the immunotherapies for rare diseases and the repurposing of drugs as they are covered by other topics in the HE research programme 2021-2022. Research on cancer immunotherapies is excluded as it will be covered by the Mission on Cancer.

[10] In case proposals are involving clinical studies, please use the document on essential information for clinical studies provided on the portal.

All projects funded under this topic are strongly encouraged to participate in networking and joint activities, as appropriate. These networking and joint activities could, for example, involve the participation in joint workshops, the exchange of knowledge, the development and adoption of best practices, or joint communication activities. This could also involve networking and joint activities with projects funded under other clusters and pillars of Horizon Europe, or other EU programmes, as appropriate. Therefore, proposals are expected to include a budget for the attendance to regular joint meetings and may consider to cover the costs of any other potential joint activities without the prerequisite to detail concrete joint activities at this stage. The details of these joint activities will be defined during the grant agreement preparation phase. In this regard, the Commission may take on the role of facilitator for networking and exchanges, including with relevant stakeholders, if appropriate.

Projects could consider the use of the Nanobiotechnology infrastructure platform of the European Commission's Joint Research Centre, in particular for the accurate physicochemical characterization of therapeutic proteins and antibodies.

HORIZON-HLTH-2021-ENVHLTH-02-03: Health impacts of climate change, costs and benefits of action and inaction

Essentials in a nutshell:

- Circa 6 projects are expected to be funded, for €10M each
- Submission deadline: 21/09/21.

Expected Outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 2 'Living and working in a health-promoting environment'. To that end, proposals under this topic should aim for delivering results that are directed, tailored towards and contributing to all of the following expected outcomes:

- Global and EU climate policies[11], the EU Observatory for Climate and Health[12], and the Green Deal activities are supported with up-to-date scientific evidence;
- Public authorities and surveillance organisations have access to predictive and early warning systems for direct and indirect health impacts caused by climate-change induced events and dispose of indicators for improved monitoring of policy actions;

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[11] New EU Strategy on Adaptation to Climate Change adopted on 24 February 2021 (COM(2021)82)
[12] https://climate-adapt.eea.europa.eu/observatory

- Public authorities, employers and risk managers draw benefit from user-friendly tools for integrated risk assessments and cost-benefit analysis of climate change mitigation and adaptation actions to support decisions across policy sectors;
- Public and private health authorities and care providers use guidelines and training materials produced to adapt and innovate health systems and practices to prevent and mitigate climate change related health risks in cost-efficient and effective ways.

Scope:

The European Green Deal refocused the European Commission's commitment of tackling climate and environment-related challenges. It also aims to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts. In addition to aiming for climate neutrality by 2050, the Commission adopted a more ambitious EU strategy on adaptation to climate change on 24 February 2021. This is essential, as climate change will continue to create significant stress in Europe in spite of the mitigation efforts.

The World Health Organization estimates that climate change will cause at least 250 000 additional deaths per year globally between 2030 and 2050[13]. Climate change, together with other natural and man-made health stressors, can influence human health and disease patterns in numerous ways. Some existing health threats will intensify and new health threats will emerge, with variable impact on different socio-economic groups. Climate changes induce events such as changes in biodiversity, disruption of ecosystems, habitats and land use, global warming and heat waves, changes in UV exposure or flooding. These events are influencing globally the incidence and spread of infectious diseases and increasing pollution, thereby causing new threats to human health.

The aim of this topic is the identification, monitoring and quantification of direct and indirect impacts on human health, including in occupational settings, and related risk factors correlated to climate change, especially in vulnerable population groups such as children or in groups at risk such as workers. Innovative surveillance tools are further required to ensure a timely response to emerging threats, to feed and strengthen early warning systems, and to enable the design, monitoring and evaluation of interventions. This may include mathematical modelling with big data and artificial intelligence (AI), remote sensing, citizen science and biomarkers of exposure or virulence.

Proposals must choose and address one of the following areas of research:

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[13] https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health

- Development of suitable indicators and monitoring mechanisms to assess the healthrelevant outcomes of climate policies and actions;
- Development of predictive models and early warning systems for exposure and health impacts of climate change based on transparent assumptions and architecture;
- Development of tools for health impact and cost-benefit assessment of climate-change adaptation and mitigation measures;
- Investigation of health co-benefits of adaptation and mitigation policy measures outside the health sector;
- Demonstration of the validity of tools and methods developed in the above listed activities in policy-relevant case studies;
- Determination of the societal implications of climate change on health systems, including occupational health, and development of adaptation measures;
- Development of training materials and guidelines to educate relevant actors in citizens' daily life on climate change health impacts and to facilitate adaptation of health systems and practices;
- Delivery of FAIR48 data on positive and negative health impacts of climate change, including impact on groups at higher risk or vulnerability.

International cooperation is encouraged with the specific aim to support international climate policies. If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, they must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).[14]

Aspects such as gender, age, regional variations, socio-economics and culture should be considered, where appropriate.

All projects funded under this topic are strongly encouraged to participate in networking and joint activities, as appropriate. These networking and joint activities could, for example, involve the participation in joint workshops, the exchange of knowledge, the development and adoption of best practices, or joint communication activities. This could also involve networking and joint activities with projects funded under other clusters and pillars of Horizon Europe, or other EU programmes, as appropriate. Therefore, proposals are expected to include a budget for the attendance to regular joint meetings and may consider to cover the costs of any other potential joint activities without the prerequisite to detail concrete joint activities at this stage. The details of these joint activities will be defined during the grant agreement preparation phase. In this

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[14] FAIR data are data, which meet principles of findability, accessibility, interoperability, and reusability. This can include data from European data infrastructures and programmes such as Copernicus, European Space Agency and the GEO initiative.

regard, the Commission may take on the role of facilitator for networking and exchanges, including with relevant stakeholders, if appropriate.

HORIZON-HLTH-2021-CARE-05-02: Data-driven decision-support tools for better health care delivery and policy-making with a focus on cancer

Essentials in a nutshell:

- Circa 4 projects are expected to be funded, for €10M each.
- Submission deadline: 21/09/21.

Expected outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 4 "Ensuring access to innovative, sustainable and high-quality health care". To that end, proposals under this topic should aim for delivering results that are directed at, tailored towards and contributing to some of the following expected outcomes:

- Health care organisations and policymakers adopt robust and transparent modelling (including data collection, storage and analysis), planning algorithms and artificial intelligence (AI) solutions in support of health care decision-making processes;
- Health care providers, caregivers (formal and informal), citizens, and other relevant stakeholders take better informed decisions about their health or the health of persons they are responsible for and/or about the organisation of the health care service or system they are involved in or in charge of;
- Health system owners are provided with evidence-based participative decision-making processes that take into consideration all relevant values, needs and perspectives, enabling to deliver health care services to patients in the most suitable and efficient manner;
- Policymakers access evidence-based, interoperable decision support tools for public health policy-making and health care delivery.

Scope:

This call topic will contribute to Europe's Beating Cancer Plan activities[15] and other relevant initiatives such as the European Cancer Information System[16] . For this reason, proposals must

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[15] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12154-Europe-s-Beating-Cancer-Plan
[16] European Cancer Information System https://ecis.jrc.ec.europa.eu/

focus on one or more phases of the cycle of the disease, starting from prevention and early diagnosis to treatment and quality of life of patients and survivors. An ever-increasing amount of data is at the disposal of decision- and policy-makers, which, if analysed, pooled and used, could lead to novel data-driven approaches in health care delivery and policy-making, thus improving quality of life, health equity and producing better health outcomes. The collection, access, processing, and (primary and secondary) use of data is still very fragmented across national health systems. The availability and use of structured and unstructured health data represents an opportunity for the implementation of data-driven innovation and it provides new opportunities for developing, monitoring and evaluating decisions, and providing feedback into decision-making processes and policy strategies. In this topic, research and innovation actions should aim at optimising and/or transforming health care delivery decision-making processes, supporting policy-making, and/or empowering citizens and cancer patients. The development of innovations, including tools, processes and services, should be done together with end-users (i.e. citizens, health professionals and policymakers), and represent both a support-base and scientific evidence for data-driven innovation. Design thinking and other relevant design methodologies should be considered.

The proposals should adhere to the FAIR data[17] principles and adopt data quality standards, data integration operating procedures and GDPR-compliant data sharing/access best practices developed by the European research infrastructures, if relevant. In addition, the proposals are encouraged to adopt best practices of international standards used in the development of computational models.

Data-driven algorithms should be explainable, unbiased and inclusive. Caution needs to be paid to systematically control for gender and racial bias and/or discrimination bias, when developing and using data and algorithms. The actions should ensure that the novel ideas are accompanied by frameworks/guidelines for new forms of collaboration and incentivising mechanisms/tools in order to support implementation of the innovations in the public sector. The tools should aim to improve health outcomes and quality of life, not only to lower health care costs.

Actions should pursue a multi-disciplinary and multi-stakeholder approach to integrate health care research, health services research, innovation, health economics, implementation science, operations management/research, data science and other relevant disciplines (i.e. sociology and anthropology) to ensure more equitable, innovative and sustainable health care systems. Applicants should propose activities underpinned by health care data in one or more of the following areas:

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[17] FAIR data are data, which meet principles of findability, accessibility, interoperability, and reusability.

- The development of data-driven, interactive policy and visualisation tools (i.e. through creation of digital twins/virtual models) bringing novel insights on populations, systems and services as a whole, to help policymakers make data-driven decisions. These can be foreseen to be used solely for health care decisions or constitute health-relevant inputs for other sectorial approaches, and promote multi-disciplinary knowledge exchange;
- The development of data-driven solutions (i.e scenario-building tools and models) helping health care organisations take evidence-informed decisions on cancer care delivery processes such as logistics planning and management, capacity, utilisation of health services and allocation of resources and infrastructures (i.e. human resources, health goods, etc.), and availability of and access to health care technologies (i.e. pharmaceuticals, vaccines, medical devices, etc.) and interventions;
- The development of data-driven solutions empowering citizens' and cancer patients' interaction with the health care systems, including feedback mechanisms, guidance on health care pathways and on managing health care data, supporting patients in making health care decisions and treatment adherence;
- The development of digital toolkits and indicators to improve the reporting and assessment of outputs from end-user involvements, including those of patient-reported outcomes measures (PROMs) and patient-reported experience measures (PREMs), and help gauge the actual impact in health care (including interaction between patients and health care providers).

Applicants are encouraged to establish dynamic relations and synergies with the following areas, where applicable:

- Decision-making processes and tools, including social innovation;
- Monitoring and evaluating the budgetary impact of health care interventions (i.e. innovative solutions, digital services and health care models);
- Health technology assessment and cost-effectiveness analysis;
- Artificial intelligence/deep learning tools in social medicine to determine causal factors of disease/conditions and develop interventions;
- Data sharing between different institutions;
- European Health Data Space (EHDS);
- Open source and/or common building blocks used in Connecting Europe Facility (CEF) (e.g. eDelivery, eID);
- Standards and mechanisms to allow for interoperability between primary and secondary use of data;

- Privacy-preserving protocols for secondary use of data for public health policy-making and research;
- Federated/distributed access or data processing protocols for data-driven decisionsupport tools for better health care delivery and policy-making.

Proposals should adopt a patient-centred approach that empowers patients, promotes a culture of dialogue and openness between citizens/patients, caregivers, health care providers and other relevant stakeholders, and unleashes the potential for social innovation.

Whenever the data sources proposed to be used by the applicants include genomics data, the proposals should consider the data standards and legal, ethical and technical interoperability requirements and guidelines agreed under the 1+ Million Genomes Initiative[18] where relevant.

If projects use satellite-based earth observation, positioning, navigation and/or related timing data and services, beneficiaries must make use of Copernicus and/or Galileo/EGNOS (other data and services may additionally be used).

HORIZON-HLTH-2022-IND-13-01: Enhancing cybersecurity of connected medical devices

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €6M each.
- Submission deadline: 21/09/22.

Expected outcome:

This topic aims at supporting activities that are enabling or contributing to one or several expected impacts of destination 6 "Maintaining an innovative, sustainable and globally competitive health industry". To that end, proposals under this topic should aim for delivering results that are directed, tailored towards and contributing to some of the following expected outcomes:

- Stakeholders (e.g. manufacturers, suppliers, health care providers, integrators, operators) apply measures to identify and address cybersecurity risks and gaps in connected medical devices.
- Stakeholders adopt and use newly developed risk benefit analysis schemes and capabilities for cybersecurity of connected medical devices.

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[18] https://digital-strategy.ec.europa.eu/en/policies/1-million-genomes

- Stakeholders adopt and use newly developed methodologies and toolboxes for ensuring cybersecurity of connected medical devices by design.
- Stakeholders adopt and use fit for purpose guidance covering challenges posed by connected medical devices, including software.

Scope:

The proposals are expected to help strengthening cybersecurity maintaining the performance of medical devices while preserving or enhancing safety, security and data confidentiality, integrity and availability. The applicants should tackle the cybersecurity issue of connected medical devices and in vitro diagnostic medical devices, in particular those that are connected to the internet, allow remote access to data and exchange private or proprietary data. They should also consider the implications of Regulation (EU) 2017/745[19] on medical devices and Regulation (EU) 2017/746[20] on in vitro diagnostic medical devices regarding qualification and classification of software. In their proposals, applicants should consider to maximise synergies with relevant initiatives, activities and programmes.

Proposals are expected to address some or all of the following:

- Systematic review of current standards/guidelines/best practices applied to cybersecurity of connected medical devices, with the final objective to identify and specify gaps and requirements based on evidence.
- Propose risk benefit analysis schemes for cybersecurity of connected medical devices, taking into account several novel technological developments (e.g. 5G networks, big data, artificial intelligence, cloud computing, augmented reality, blockchain) and interconnection architectures.
- Explore, develop and validate novel methodologies and toolboxes for ensuring cybersecurity of connected medical devices by design.
- Identify representative case studies, evaluate the applicability of existing guidance MDCG 2019-16 (guidance on cybersecurity for medical devices21) and make recommendations to (better) address specificities of the connected medical device, including software, of different risk classes.
- Assessment of the applicability (and revision) of current guidance, the MDCG 2019-16 (guidance on cybersecurity for medical devices), to connected medical device, including software.

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[19] OJ L 117, 5.5.2017, p. 1
[20] OJ L 117, 5.5.2017, p. 176
[21] https://ec.europa.eu/docsroom/documents/41863

All projects funded under this topic are strongly encouraged to participate in networking and joint activities, as appropriate. These networking and joint activities could, for example, involve the participation in joint workshops, the exchange of knowledge, the development and adoption of best practices, or joint communication activities. This could also involve networking and joint activities with projects funded under other clusters and pillars of Horizon Europe, or other EU programmes, as appropriate. Therefore, proposals are expected to include a budget for the attendance to regular joint meetings and may consider to cover the costs of any other potential joint activities without the prerequisite to detail concrete joint activities at this stage. The details of these joint activities will be defined during the grant agreement preparation phase. In this regard, the Commission may take on the role of facilitator for networking and exchanges, including with relevant stakeholders, if appropriate. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Culture, creativity and inclusive society cluster

Topics summary

Topic name	Deadline	Funding per project
HORIZON-CL2-2022-DEMOCRACY-01-01: Artificial intelligence, big data and democracy	20.4.22	€2-3M
HORIZON-CL2-2021-HERITAGE-01-04: Preserving and enhancing cultural heritage with advanced digital technologies	7.10.21	€3.5-4M
HORIZON-CL2-2021-TRANSFORMATIONS-01-05: Integration of emerging new technologies into education and training	7.10.21	€2-3M

Essentials in a nutshell:

- Circa 3 project is expected to be funded, for €2-3M each
- Submission deadline: 20.4.22

Expected Outcome:

Projects should contribute to at least two of the following expected outcomes:
- Protect fundamental rights and European values from possible threats stemming from unregulated use of artificial intelligence (AI) and big data applications.
- Explore the potential of AI and big data to reinforce fundamental rights and European values. Examine the effectiveness of monitoring and control protocols of established legislation and non-regulatory measures over AI and big data development and implementations.
- Introduction of values-based frameworks to inform data governance and regulate the use of AI and big data.
- Innovative uses of AI and big data to enhance citizen engagement and democracy.

Scope:

Big data and AI are shaping our societies at an unprecedented rate. We produce an ever-increasing amount of data revealing people's attitudes, preferences, views and opinions. Public and private actors collect it and use it in multiple ways: e.g. companies "privatise" data to augment commercial returns while, on the other hand, state actors can use it for safety and security applications and the public sector to provide better, tailored services to citizens.

AI and big data open great opportunities in many fields of public interest: education, training, health, safety and security, public services, as well as for democratic processes and civic participation. However, both private and public uses contain some risks at the expense of citizens' rights. These technologies, being at the forefront of datafication processes, pose new challenges both to core individual values such as privacy, freedom and equality, as well as to European collective values, such as fairness, security, inclusiveness, accountability and democratic control.

Proposals should analyse challenges and opportunities for society brought about by AI and big data. They should explore how to protect citizens from potential abuse enabled by these technologies both in the private and public domains. New and established regulations to control platforms using these technologies (beyond GDPR) should be examined. Strategies and policy

recommendations on how to ensure that philosophical, legal and ethical values are embedded in the development of these technologies as outlined in the White Paper on Artificial Intelligence – a European approach to excellence and trust[22], are sought.

Examination should lead to solutions protecting from the possible negative impacts of these technologies on fundamental rights and democracy. Equally, it should lead to strategies that leverage them for enhancing civic participation and democracy.

Issues at stake include, inter alia: data ownership and/or inalienability; regulation of data flows; neutrality and explainability of algorithms and machine learning; value-centric, decentralised and/or open source designs for data processing platforms; counter-powers to dominant platforms; sensitive applications such as face recognition; etc.

Proposals are expected to address some of the following points: To build evidence, to review and to analyse threats to and opportunities for democracy, personal and collective European values stemming from AI and big data. This should involve a specific focus on gender issues and vulnerable populations, including persons with disabilities and people at risk of discrimination. They should propose ethical standards enforced through regulatory and governance frameworks. Supported with operational guidance, they should help protect citizens, uphold European values and ensure public trust in AI and the processing of big data. Innovative, inclusive and participative uses of AI and big data for civic engagement and democracy, including through experimental approaches, should be explored. Research is expected to design ways to educate European citizens about these technologies to enable informed civic participation in shaping them. Projects should build on existing results, findings and good practices, for instance those focused on Responsible Research and Innovation, and relevant projects supported under Horizon 2020's Science with and for Society programme.

HORIZON-CL2-2021-HERITAGE-01-04: Preserving and enhancing cultural heritage with advanced digital technologies

Essentials in a nutshell:

- Circa 3 project is expected to be funded, for €3.5-4M each
- Submission deadline: 7.10.22

Expected outcome:

Projects should contribute to at least two of the following expected outcomes:

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[22] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/excellence-trust-artificial-intelligence#documents

- Develop and strengthen the use of digital technologies to protect, preserve, restore and safeguard cultural heritage and the arts in complementarity to other research methods.
- Facilitate and widen access to cultural assets through digital and cutting-edge technologies and tools, in parallel or as an alternative to physical access to cultural heritage.
- Support comparative analysis with artificial intelligence, including analysis across time, and other digital means to improve innovation and knowledge exchange in the cultural and creative sectors.
- Increase the competitiveness of cultural and creative industries in the internal market and internationally, and provide opportunities for new and sustainable jobs creation.
- Explore the role of digital tools, such as 3D/4D simulations, virtual and augmented reality technologies in engaging with cultural heritage during and after the COVID-19 crisis.
- Use digital tools and other outcomes to provide efficient and global solutions to the real needs of accessing, protecting and preserving cultural heritage, including the "born digital" one.

Scope:

Digital technologies, from 3D simulation to artificial intelligence and virtual/augmented reality, are being used to ensure preservation and wide access to cultural heritage and the arts. Extensive research has been already funded to support the digitisation of libraries and archives, virtual tours of museums and archaeological sites, as well as digital curation and preservation of cultural goods. However, there is need to expand and further support the application of digital tools to preserve cultural heritage and to make it widely accessible. The relation between cultural heritage and its digitised format through the experience of audiences is of particular interest. Moreover, the "born digital" heritage, in parallel to the digitised one, is becoming of increased importance, requiring further research on its intrinsic value and limitations of use.

The role played by digital during the recent COVID-19 pandemic crisis is especially noteworthy, as it proved to be the most valuable means to access cultural assets during the extended period of confinement. Museums and libraries offered free access to their collections, artists were performing live online and theatres where streaming their performances through the web to help lift up people's morale and improve their well-being. Assessing the impact of these activities and drawing lessons in view of future crisis management requires targeted research.

Taking these points into account, R&I actions under this topic are envisaged to promote extended digitisation so that collections, artefacts and monuments, including the "born digital" heritage, can be preserved, restored and safeguarded in a sustainable and user-friendly way. At the same time, research should prevent any potential negative consequence of doing so. In addition, digitisation practices have to comply with intellectual property law, in particular copyright law. They should develop digital facilities that will allow building shared infrastructures, provide

specialised trainings and courses and facilitate knowledge and knowhow exchange to address real needs in the field of cultural heritage. Projects should thus increase the use of existing tools and cutting-edge technologies, such as virtual and augmented reality or artificial intelligence, to reduce access and knowledge limitations to cultural assets. By assessing the role of digitisation in engaging with culture and cultural heritage during the COVID-19 crisis, they should draw lessons and provide resilient policy scenarios or recovery tools for the cultural and creative sectors in a post-crisis era. By creating new or fostering existing tools, they should aim at boosting the socio-economic sustainability of cultural and creative industries in the COVID-19 post-crisis period and provide sustainable applications and solutions to strengthen their innovation potential as well as manage future crises. This requires collaboration between technological firms, research institutes, universities and cultural and creative sectors/industries to generate tailor made know-how and transfer expertise to foster the digital transformation of Cultural Heritage institutions. Innovative approaches to R&I including user-led innovation could be applicable.

R&I actions funded under this topic are expected to establish the state of the art of digital methodologies and tools to protect the rich and diverse European cultural heritage, including the "born digital" heritage, in complementarity with more established conservation and protection methods. Data and products coming from the Copernicus services, specifically Copernicus Emergency, Copernicus Atmosphere Monitoring, Climate Change and Copernicus Land Monitoring Services can give a great support in preserving cultural and natural heritage sites.

Essentials in a nutshell:

- Circa 3 project is expected to be funded, for €2-3M each
- Submission deadline: 7.10.21

Expected outcome:

Projects should contribute to all of the following expected outcomes:

- Increase the shared critical understanding of the potential, opportunities, barriers, accessibility issues and risks of using emerging technologies for teaching and learning, as well considering the framework for the sustainable digitisation of education and learning in the future.
- Support education and training systems with research on the adaptation and mainstreaming of the use of digitally enhanced pedagogies, in order to augment and extend learning, while also maintaining its human dimension and social relevance.
- Share evidence and good practice on equipping teachers, trainers, educational leaders and learners with the skills necessary for the use of technology in creative, critical, competent and inclusive ways.
- Analyse the needs for adequate teacher training in relation with new educational technologies.

Scope:

Proposals should support the purposeful and pedagogical use of emerging technologies, including applications of artificial intelligence (AI), virtual reality (VR), augmented reality (AR) and robotics in education and training, in order to foster 21st century skills such as communication, collaboration, digital literacy, critical as well as design thinking and creativity. This in turn should allow for more personalized and flexible ways of learning, including online and blended delivery. Proposals should also examine the link with big data, learning analytics and artificial intelligence, to efficiently support distance learning. Research should focus on how different learners experience and benefit, or are excluded from, digitally enhanced learning (e.g. male and female students, students of a migrant background, students with disabilities, and/or learning difficulties, gifted and talented students, urban and rural populations, young and adult learners, etc.). Proposals should tackle as well the potential negative effects of using technologies in schools, such as cyber bullying, while also looking at the positive effects of using such technologies to increase students' learning opportunities. In addition, the research should explore the effects of digital technologies on the learning of basic skills. It should also examine the resilience and the capacity for effective massdeployment of e-learning capabilities in cases

of crises, major emergencies such as the COVID-19 pandemic, disruptive events as well as man-made or natural disasters, which can undermine the human and social dimension of learning. Finally, it should also explore multistakeholder involvement and cooperation patterns in this context. The perspectives of educators, parents, and students should inform this analysis.

The action should identify barriers, enablers and framework conditions for successfully embedding emerging technologies in educational practices, including necessary innovation skills for teachers. It should also look at the positive and negative effects of digital technologies on learning, educational outcomes and basic skills. This should be done in sustainable and ecologically responsible ways, addressing accessibility in an inclusive manner, and providing for the gradual move from small-scale projects and pilots to mainstream implementation and adoption. The ethical use of data generated by digital learning platforms and tools should equally be a particular focus. Finally, the proposals should also assess potential vulnerabilities and negative unforeseen consequences, which might arise from the use of new technologies.

Proposals should analyse the shifting role of teachers, trainers and educational leaders in the digital transition affecting education and training as well as their training needs, including digital and leadership skills, required in an emerging society of permanent and quick technological change. The action should address the active involvement of educators in shaping and co-designing education and training technological products and tools. The proposals should also examine the support necessary for Initial Teacher Education institutions for the development of innovative training programmes for pre-service teachers, fostering their future digital competence and confidence.

Civil Security for Society cluster

Topics summary

Topic name	Deadline	Funding per project
HORIZON-CL3-2021-CS-01-03: AI for cybersecurity reinforcement	21.10.21	€3-4M
HORIZON-CL3-2021-DRS-01-02: Integrated Disaster Risk Reduction for extreme climate events: from early warning systems to long term adaptation and resilience building	23.11.22	€6M
HORIZON-CL3-2021-DRS-01-03: Enhanced assessment of disaster risks, adaptive capabilities and scenario building based on available historical data and projections	23.11.22	€5M
HORIZON-CL3-2022-DRS-01-06: Improved disaster risk pricing assessment	23.11.22	€5M
HORIZON-CL3-2022-CS-01-01: Improved monitoring of threats, intrusion detection and response in complex and heterogeneous digital systems and infrastructures	16.11.22	€4-6M
HORIZON-CL3-2021-CS-01-04: Scalable privacy-preserving technologies for crossborder federated computation in Europe involving personal data	21.10.21	€4M
HORIZON-CL3-2022-CS-01-04: Development and validation of processes and tools used for agile certification of ICT products, ICT services and ICT processes	16.11.22	€3-5M

HORIZON-CL3-2021-CS-01-03: AI for cybersecurity reinforcement

Essentials in a nutshell:

- Circa 3 project is expected to be funded, for €3-4M each
- Submission deadline: 21.10.21

Expected Outcome:

Projects are expected to contribute to some of the following expected outcomes:
- Reinforced cybersecurity using AI technological components and tools in line with relevant EU policy, legal and ethical requirements.
- Increased knowledge about how an attacker might use AI technology in order to attack IT systems.
- Digital processes, products and systems resilient against AI-powered cyberattacks.

The proposal should provide appropriate indicators to measure its progress and specific impact.

Scope:

Artificial intelligence (AI) is present in almost every application area where massive data are involved. Understanding the implications and possible side effects for cybersecurity however requires deep analysis, including further research and innovation. On the one hand, AI can be used to improve response and resilience such us for the early detection of threats and other malicious activities with the aim to more accurately identify, prevent and stop attacks. On the other hand, attackers are increasingly powering their tools by using AI or by manipulating AI systems (including the AI systems used to reinforce cybersecurity).

The proposed actions should develop AI-based methods and tools in order to address the following interrelated capabilities: (i) improve systems robustness (i.e. the ability of a system to maintain its initial stable configuration even when it processes erroneous inputs, thanks to self-testing and self-healing); (ii) improve systems resilience (i.e. the ability of a system to resist and tolerate an attack, anticipate, cope and evolve by facilitating threat and anomaly detection and allowing security analysts to retrieve information about cyber threats); (iii) improve systems response (i.e. the capacity of a system to respond autonomously to attacks, thanks to identifying vulnerabilities in other machines and operate strategically by deciding which vulnerability to attack and at which point, and by deceiving attackers; and to (iv) counter the ways AI can be used for attacking. Advanced AI-based solutions, including machine learning tools, as well as defensive mechanisms to ensure data integrity should also be included in the proposed actions. Proposals

should strive to ultimately facilitate the work of relevant cybersecurity experts (e.g. by reducing the workloads of security operators).

Regarding the manifold links among AI and cybersecurity, privacy and personal data protection, applicants should demonstrate how their proposed solutions comply with and support the EU policy actions and guidelines relevant to AI (e.g. Ethics Guidelines for Trustworthy AI[23], the AI Whitepaper[24], EU Security Strategy[25] and the Data Strategy[26]). Proposals should foresee activities to collaborate with projects stemming from relevant topics included in the Cluster 4 "Digital, Industry and Space" of Horizon Europe. Generally, proposals should also build on the outcomes of and/or foresee actions to collaborate with other relevant projects (e.g. funded under Horizon 2020, Digital Europe Programme or Horizon Europe).

Proposals should strive to use, and contribute to, European relevant data pools (including federations of national and/or regional ones to render their proposed solutions more effective. To this end, applicants should crucially strive to ensure data quality and homogeneity of merged/federated data. Applicants should also identify and document relevant trade-offs between effectiveness of AI and fundamental rights (such as personal data protection). Moreover, privacy in big data should also be addressed.

Key performance indicators (KPI), with baseline targets in order to measure success and error rates, should demonstrate how the proposed work will bring significant progress to the state-of-the-art. All technologies and tools developed should be appropriately documented, to support take-up and replicability. Participation of SMEs is encouraged.

HORIZON-CL3-2021-DRS-01-02: Integrated Disaster Risk Reduction for extreme climate events: from early warning systems to long term adaptation and resilience building

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €6M each
- Submission deadline: 23.11.21

Expected Outcome:

Projects' results are expected to contribute to some of the following outcomes:

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[23] https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai
[24] https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en
[25] https://ec.europa.eu/info/strategy/priorities-2019-2024/promoting-our-european-way-life/european-security-union_en
[26] https://ec.europa.eu/info/strategy/priorities-2019-2024/europe-fit-digital-age/european-data-strategy_en

- Improved dialogue and cooperation among scientific and technical communities, stakeholders, policy-makers and local communities in the field of extreme climate events and associated events (e.g. forest fires, droughts, floods, heatwaves and storms) and disaster risk reduction.
- Enhanced community engagement for prevention, preparedness, response, recovery and learning to extreme climate events by strengthening knowledge and involvement of volunteers linked to recognised organisations into the planning, design and implementation of prevention, including building with nature, preparedness and emergency response activities.
- Strengthening of disaster risk reduction and resilience building through innovative use of media means, namely by examining the potential of new communication tools and apps for better preparedness and response.
- Overview of existing knowledge, tools and development of new tools (innovative data collection, satellite data, data harmonisation, artificial-intelligence tools, algorithms, sensors and decision-aid approaches) for early warning, response and resilience / adaptation to be demonstrated in the framework of real-case scenarios designed for training addressed to first and second responders, (national, regional, local) authorities and populations. The overview should document how legal and ethical rules of operation as well as fundamental rights such as privacy and protection of personal data are taken into account.
- Based on the demonstrations, development of new governance strategies and robust decision-support methodologies for integrated risk reduction and improved adaptation to climate extreme events.
- Improved understanding of enablers and barriers to multi-risk governance frameworks and multi-risk thinking, by involving interdisciplinary teams in different fields, particularly the social and behavioural sciences.
- Cost-benefit or cost-effectiveness analyses of investment and regulatory strategies to protect people and nature in vulnerable areas.
- Identification of production/livelihood practices (goods, services, activities etc.) at community and national level that contribute to increased local/global climate risks, and explore how these can be adapted so that they are both economically and environmentally sustainable.

Scope:

In contemporary society, the capacity of communities and governments to manage expected and/or unexpected extreme climate events depends heavily on effective governance throughout

the entire Disaster Risk Management cycle. This covers operational mechanisms ranging from short-term actions (e.g. early warning and forecast-based actions) to long-term adaptation strategies and resilience building, including nature-based solutions. A coherent integration between Disaster Risk Reduction, Climate Adaptation policies and Sustainable Development Goals as fostered by the European Green Deal and major UN initiatives should result in a comprehensive resilience framework, while improving synergies and coherence among the institutions and international agencies involved.

The effective implementation of global and European risk governance and policies to enable integrated disaster risk reduction for extreme climate events requires a collaborative involvement in risk assessment and information sharing across involved institutions, including the civil and private sector and the population.
The effective implementation of global and European risk governance and policies to enable integrated disaster risk reduction for extreme climate events requires a collaborative involvement in risk assessment and information sharing across involved institutions, including the civil and private sector and the population.

Cross-regional, cross-border and cross-sector agreements covering all phases of Disaster Risk Management can improve the knowledge about extreme climate events such as forest fires, droughts, floods, heatwaves, storms and storm surges. In addition, improving effective prevention, preparedness and response rely upon specific national or local expertise and experience. It is important to overcome silos between technical and political authorities at all levels and advocate integration among involved actors. Multi-risk governance frameworks related to climate extremes, shifting from single to multi-risk thinking in governmental agencies, represents the key challenge for the future, considering how measures to improve the resilience of the built environment and communities may provide effective solutions to strengthen adaptation measures.

Creating an overview of existing knowledge, integrating tools and developing new ones for resilience and emergency management should include careful planning for interoperability amongst many actors. It is important that solutions pay attention to societal side-effects of integrating data about emergencies, for instance Apps, where persons concerned tend to share more willingly, but do not reflect consequences of that. Thus, the development of data management tools for emergencies need to respect fundamental rights, data protection and avoid function creep.

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

Where possible and relevant, synergy-building and clustering initiatives with successful proposals in the same area should be considered, including the organisation of international conferences in close coordination with the Community for European Research and Innovation for Security (CERIS) activities and/or other international events.

HORIZON-CL3-2021-DRS-01-03: Enhanced assessment of disaster risks, adaptive capabilities and scenario building based on available historical data and projections

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €5M each
- Submission deadline: 23.11.21

Expected Outcome:

Projects' results are expected to contribute to some of the following outcomes:

- Innovative exposure and vulnerability analysis methods, including those that take a systemic perspective by integrating sectoral expertise (e.g. social science, human health, cultural heritage, environment and biodiversity, public financial management and key economic sectors) and identifying key vulnerable groups and assets.
- Maximising usability through a service-oriented approach, including through the optimisation and tailoring recommended practices, scientific models and scenarios for the intended users to support technical policy improvements and implementation of actions.
- Enhanced exploitation of monitoring data and satellite/remote sensing information as well as artificial intelligence to improve high-level assessment from international to local levels, identifying the major sources of uncertainty in hazard assessment and ways to reduce them.
- Evaluation of existing disaster risk and resilience assessment and scenarios (at national and local levels), taking into account historical / geological data, monitoring, risk and forecasting data, and based on the evaluation, serious games, modelling of future scenarios accounting for current and future impacts of diverse extreme events and disasters.

Scope:

The assessment of disaster risks requires different types of actions ranging from soft measures to technologies. Simulation-based risk and impact assessments represent an effective approach to make science understandable to decision makers and streamline national to local mitigation/adaptation actions. This is especially the case if they are integrated with evaluation tools for cost-benefit/effectiveness and multi-criteria analyses, data-farming experiments, serious games, and are tailored to meet end-user's needs, to assess the effectiveness of alternative options in different phases of the Disaster Risk Management cycle.

Specific risk assessments should be decision- or demand-driven and informed by scientific evidence, and there is a clear need to translate the results to ensure they are relevant, usable, legitimate and credible from the perspectives of the users. Co-design, co-development, codissemination and co-evaluation engaging the intended end users represent in this sense key features of improved risk, resilience and impact assessments.

In a first place, the acquisition of data is an essential feature and this requires innovative solutions for faster risk assessment and reduction. This includes the identification of precursors for different types of threats, supporting the design or improvement of risk-targeted monitoring programmes. In addition, risk assessments themselves are primarily designed to predict the likelihood of a specific event, whereas what is of primary concern is the impact of that event on society, infrastructure, governance, etc. Numerous experiences gathered in the natural hazards area showed that an enhanced assessment of risks and scenario building may be improved by taking into account reliable data (both quantitative and qualitative) and historical occurrences, when available, including disaster loss data (studies of past events in particular low-probability / long-time recurrence events). This includes for example a higher completeness of the historical-geological records of volcanic eruptions, major earthquakes, tsunamis etc.

In the case of extreme climate events such as storms and related storm surges, or health crises (outbreaks, pandemics) the analysis should draw on the outputs of state-of-the-art climate projections, including by taking into account the uncertainties brought on by climate change and our state of knowledge of the key processes underpinning the functioning of the Earth system.In cases where there are not be enough historical data and a high level of uncertainty, assessments and decision making will have to rely on qualitative data.

The action should take into account disaster loss databases and risk data repositories in Member States and relevant hubs. This topic requires the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities. In order to achieve the expected outcomes, international cooperation is encouraged.

Where possible and relevant, synergy-building and clustering initiatives with successful proposals in the same area should be considered, including the organisation of international conferences in close coordination with the Community for European Research and Innovation for Security (CERIS) activities and/or other international events.

HORIZON-CL3-2022-DRS-01-06: Improved disaster risk pricing assessment

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €5M
- Submission deadline: 23.11.22

Expected Outcome:

Project results are expected to contribute to some of the following expected outcomes:

- Contribute to the public accessibility of fiscal data and information related to disaster risks, and available risk transfer mechanisms such as insurance in an easily available and understandable way.
- EU-wide or international standard or guidance on how to monetise and account intangible values from Climate Adaptation and Disaster Risk Reduction measures.
- Innovative financial instruments and IT-solutions to reduce transaction costs for disaster risk finance and insurance products (e.g. earth observation data, artificial intelligence, financial technologies)
- Research and testing of novel European, cross-border, national and regional disaster risk financing frameworks. This needs to involve a wide range of stakeholders (e.g. disaster risk management, finance, communication) from public and private sectors.
- Risk model development for future natural catastrophe events, development of European stress-testing scenarios including vulnerable hotspots and uninsurable risks.

Scope:

Natural disasters (weather and climate related extremes and geological events) in the EU have cost on average EUR 17 billion per year the past ten years. Around 35 % of the total losses from climate and extreme and weather events are insured today in the EU, although the proportion of the insured losses ranges from 1 % in Romania and Lithuania to about 60 % in Belgium. In the near-term future, the European insurance industry and their regulators have warned that affordability and insurability are likely to become an increasing concern with climate change. Insurance, in combination with other risk transfer and financing mechanisms, is an important tool

to achieve disaster risk reduction targets. Insurance plays an important role in financially supporting the recovery of individuals, organisations, businesses and communities affected by natural disasters. Large disaster losses in recent years have led insurance companies to re-examine their approach to increase the extent of insurance coverage and compensation for loss in vulnerable areas. This includes increasing their investment in assessing and modelling risk, developing advice on risk prevention and establishing new forms of coverage to support governments in managing the costs they face in post-disaster recovery. Questions remain about the limits of insurance in tackling fast-rising threats - not only how people at highest risk and with lower incomes can afford it, but whether insurance models can cope with much more frequent and destructive. Rethinking insurance pay-outs, giving homeowners clearer information on potential risks - using simple online tools, or providing data at the time of house purchases - may also be the way forward more resilient communities.

HORIZON-CL3-2022-CS-01-01: Improved monitoring of threats, intrusion detection and response in complex and heterogeneous digital systems and infrastructures

Essentials in a nutshell:

- Circa 4 project is expected to be funded, for €4-6M each
- Submission deadline: 16.11.22

Expected Outcome:

Projects are expected to contribute to at least three of the following expected outcomes:

- Improved disruption preparedness and resilience of digital infrastructure in Europe.
- Improved capacity building in digital infrastructure security including organisational and operational capabilities.
- Robust evidence used in cybersecurity decisions and tools.
- Better prediction of cybersecurity threats and related risks.
- Improved response capabilities based on effective collaboration and/or coordination with other relevant national or EU bodies in charge of Cybersecurity, including holistic incident reporting and enabling coordinated cyber-incident response.

The proposal should provide appropriate indicators to measure its progress and specific impact.

Scope:

Digital infrastructures together with their connected devices are characterised by complex interdependencies involving various physical and logical layers and connecting a wide range of

legacy IT solutions and innovative technologies. Application scenarios include but are not limited to cybersecurity of communication systems and networks and their components, e.g. 5G networks, Internet of Things (IoT) devices, medical devices, supervisory control and data acquisition (SCADA) systems, and their services, e.g. cloud-based ICT solutions. Their availability, controlled performance and reliability need to be guaranteed at every moment serving the needs, sometimes critical and safety-related e.g. in transportation, energy, healthcare, of millions of citizens, enterprises and society. Therefore, they need to be protected in real-time against ever-evolving cybersecurity threats.

Building on research and innovation in the area of cybersecurity of digital infrastructures for example projects funded from H2020 SU-DS01-2018[27], SU-DS04-2018-2020[28], SU-DS05- 2018-2019[29] and SU-TDS-02-2018[30], state of the art technologies should support the logging, categorisation, data aggregation from different sources, automatic information extraction and analysis of cybersecurity incidents. This includes advanced methods for cyber threats intelligence and cyber-incident forensics enabling better prediction of cyber security threats. Proposals should develop and validate demonstration prototypes of tools and technologies to monitor and analyse cybersecurity incidents in an operational environment in line with the NIS directive and the General Data Protection Regulation. They should contribute to improved penetration testing methods and their automation by using machine learning and other AI technologies as appropriate. Moreover, proposals should support effective network traffic analysis applying detection techniques in network operations based on advanced security information management and threat intelligence. Proposed solutions should also include validation or piloting of cyber threat intelligence with early-stage detection, prediction and contributions towards response capability using predictive analytics, and as relevant, with efficient and user-friendly interaction methods, e.g. visual analytics. Furthermore, solutions deployed by this action should validate their approach to intrusion detection and incident monitoring with real end-users and their needs.

Part B of the General Annexes. Each consortium will define the selection process of the third parties for which financial support will be granted (typically in the order of EUR 50 000 to 300 000 per party). Up to 20% of the EU funding requested by the proposal may be allocated to the purpose of financial support to third parties. A strong culture awareness of data protection should be fostered. The proposals should also appropriately address concerns about mass surveillance and protection of personal spaces. All technologies and tools developed should be appropriately documented, to support take-up and replicability. Consortia should bring together

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[27] Cybersecurity preparedness - cyber range, simulation and economics

[28] Cybersecurity in the Electrical Power and Energy System (EPES): an armour against cyber and privacy attacks and data breaches

[29] Digital security, privacy, data protection and accountability in critical sectors

[30] Toolkit for assessing and reducing cyber risks in hospitals and care centres to protect privacy/data/infrastructures

interdisciplinary expertise and capacity covering the supply and the demand side. Participation of SMEs is strongly encouraged. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL3-2021-CS-01-04: Scalable privacy-preserving technologies for crossborder federated computation in Europe involving personal data

Essentials in a nutshell:

- Circa 4 project is expected to be funded, for €3-5M each
- Submission deadline: 21.10.21

Expected Outcome:

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

- Improved scalable and reliable privacy-preserving technologies for federated processing of personal data and their integration in real-world systems.
- More user-friendly solutions for privacy-preserving processing of federated personal data registries by researchers.
- Improving privacy-preserving technologies for cyber threat intelligence and data sharing solution.
- Contribution to promotion of GDPR compliant European data spaces for digital services and research (in synergy with topic DATA-01-2021 of Horizon Europe Cluster 4).
- Strengthened European ecosystem of open source developers and researchers of privacypreserving solutions The proposal should provide appropriate indicators to measure its progress and specific impact.

Scope:

Using big data for digital services and scientific research brings about new opportunities and challenges. For example, machine learning methods process medical and behavioural data for finding causes and explanations for diseases or health risks. However, a large amount of this data is personal data. Leakage or abuse of this kind of data and potential privacy infringement (e.g. attribute disclosure or membership inference) risks are a cybersecurity threat to individuals, society and economy and an impediment for further developing data spaces involving personal data. Vice versa, adequate protection of this data according to the GDPR can also prevent its full utilization for society. Advanced privacypreserving computation techniques such as homomorphic encryption, secure multiparty computation, and differential privacy are being

researched and have proven promising to address these challenges. However, further research is required to ensure their applicability in real-world use case scenarios. For example, fully homomorphic encryption is not practically applicable in many cases and secure multi-party computation often imposes special infrastructural requirements.

Building on research and innovation in the area of privacy-preserving computation, proposals should address scalability and reliability of privacy-preserving technologies in realistic problem areas and take integration with existing infrastructures and traditional security measures (e.g. access control) into account. They should respond to users' needs, e.g. for research and digital services in access and data management for citizens geared towards their own profiles (incl. dynamic personalised recommendations for improved cybersecurity) or in personalised medicine, taking into account the gender dimension where relevant. They should further address the legacy variation in personal data types and data models across different organisations in the same business sector and/or across different potential application sectors. A proposed solution should include validation or piloting of privacy-preserving computation in realistic federated data infrastructures and more specifically European data spaces involving personal data (e.g. the EU heath data space). It should be guided by the EU's high standards concerning the right to privacy, protection of personal data, and the protection of fundamental rights in the digital age. It should ensure, by-design, compliance with data regulations and specifically the GDPR. Wherever possible, solutions should be developed as open source software.

Consortia should bring together interdisciplinary expertise and capacity covering the supply and the demand side, i.e. industry, service providers and end-users. Participation of SMEs is strongly encouraged. Legal expertise should also be incorporated to assess and ensure compliance of the technical project results with data regulations and the GDPR.

HORIZON-CL3-2022-CS-01-04: Development and validation of processes and tools used for agile certification of ICT products, ICT services and ICT processes

Essentials in a nutshell:

- Circa 4 project is expected to be funded, for €3-5M each
- Submission deadline: 16.11.22

Expected Outcome:

Projects are expected to contribute to at least three of the following outcomes:

- Availability of applicable tools and procedures for partial and continuous assessment and lean re-certification of ICT products, ICT services and ICT processes;

- Reduction of time and efforts spent for (re-) certifying ICT products, ICT services and ICT processes;
- Improved stakeholder collaboration on cybersecurity certification information, including manufacturers and end users from different Member States;
- Efficient (re-)use of information and evidence relevant to certification and in support of multi-scheme (re-)use;
- Integration of certification on the whole system modelling, verification, testing and verification process.
- Increased comparability of assurance statements arising from certification schemes and the standards used therein; avoidance of multi-certification;
- Advancing test and simulation facilities, including incident and threat analysis;
- Increased Digital Twin capabilities for continuous assessment and integration of new solutions.

The proposal should provide appropriate indicators to measure its progress and specific impact.

Scope:

In order to foster the application of security standards, agile certification and continuous assessment of cyber resilience systems, actions will cover the harmonising, packaging and distributing of certification processes for contemporary ICT products, services, and processes but to new and disruptive technologies as well, such as AI and High Performance Computing.

To support cybersecurity autonomy of the EU, approaches concerning a dynamic, real time, collaborative vulnerability testing and information sharing should be developed and build on existing resources (including the work carried out in preparation of the EU cybersecurity certification framework, as established by the EU Cybersecurity Act). The resources may range from tools, procedures, practices, and information sources, such as checklists, flaw repositories deployment and configuration guidance, and impact assessments posted by European industries, manufacturers, developers, CSIRTs, ISACs (Information Sharing and Analysis Centres), or national and international authorities (e.g. NIST, JVN) and relevant standards.

The actions should aim at improving certification processes, tools, evidence presentation and assurance statements, at least in quantifiable terms, where relevant by relying on a suitable IT security metric and should complement or aid other certifications relevant in other sectors or risk scenarios.

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

Digital, Industry and Space cluster
Topics summary

Topic name	Deadline	Funding per project
HORIZON-CL4-2021-TWIN-TRANSITION-01-01: AI enhanced robotics systems for smart manufacturing (AI, Data and Robotics - Made in Europe Partnerships) (IA)	23.9.21	€8-10M
HORIZON-CL4-2021-TWIN-TRANSITION-01-07: Artificial Intelligence for sustainable, agile manufacturing (AI, Data and Robotics - Made in Europe Partnerships) (IA)	23.9.21	€4-6M
HORIZON-CL4-2022-DATA-01-02: Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge (RIA)	5.4.22	€4-6M
HORIZON-CL4-2021-SPACE-01-12: Future space ecosystems: on-orbit operations, new system concepts	16.2.22	€1-2M
HORIZON-CL4-2022-SPACE-01-41: Copernicus Marine Environment Monitoring Service evolution	16.2.22	€8-10M
HORIZON-CL4-2022-SPACE-01-62: Space Weather	16.2.22	€0.5-1M
HORIZON-CL4-2021-HUMAN-01-03: European Network of AI Excellence Centres: Pillars of the European AI lighthouse (RIA)	21.10.21	€9M
HORIZON-CL4-2021-HUMAN-01-02: European coordination, awareness, standardisation & adoption of trustworthy European AI, Data and Robotics (AI, Data and Robotics Partnership) (CSA)	21.10.21	€4-9M
HORIZON-CL4-2021-HUMAN-01-13: eXtended Reality Modelling (RIA)	21.10.21	€4.8M
HORIZON-CL4-2021-HUMAN-01-26: Workforce skills for industry 5.0 (RIA)	21.10.21	€5M

HORIZON-CL4-2022-HUMAN-01-02: European Network of AI Excellence Centres: Expanding the European AI lighthouse (RIA)	5.4.22	€11.5M
HORIZON-EUSPA-2021-SPACE-02-53: EGNSS applications for the Digital Age	?	?
HORIZON-CL4-2021-DATA-01-03: Technologies for data management (AI, Data and Robotics Partnership) (IA)	21.10.21	€5M
HORIZON-CL4-2022-DATA-01-02: Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge (RIA)	5.4.22	€4-6M
HORIZON-CL4-2021-DIGITAL-EMERGING-01-01: Ultra-low-power, secure processors for edge computing (RIA)	21.10.21	€8-10M
HORIZON-CL4-2021-DIGITAL-EMERGING-01-09: AI, Data and Robotics for the Green Deal (AI, Data and Robotics Partnership) (IA)	21.10.21	€3-5M
HORIZON-CL4-2021-DIGITAL-EMERGING-01-10: AI, Data and Robotics at work (AI, Data and Robotics Partnership) (IA)	21.10.21	€3-5M
HORIZON-CL4-2021-DIGITAL-EMERGING-01-11: Pushing the limit of robotics cognition (AI, Data and Robotics Partnership) (RIA)	21.10.21	€5M
HORIZON-EUSPA-2022-SPACE-02-55: Large-scale Copernicus data uptake with AI and HPC	September 2022	€0.5-1M

HORIZON-CL4-2021-TWIN-TRANSITION-01-01: AI enhanced robotics systems for smart manufacturing (AI, Data and Robotics - Made in Europe Partnerships) (IA)

Essentials in a nutshell:
- Circa 3 projects are expected to be funded, for €8-10M each
- Submission deadline: 23.9.21

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

- Provide safe, highly flexible, reconfigurable and modular solutions, allowing fast response to repurposing changes in production requirements, reducing considerably programming effort and configuration time for new products;
- Demonstrate significant improvements towards a meaningful and seamless social collaboration in teams of human workers, autonomous agents and robots by exploiting the latest advancements in AI, robotics and Social Sciences and Humanities (SSH);
- Create a network of open-access pilots to allow new users, especially students, start-ups, representatives from the makers' community and SMEs, to experiment new technologies and to enable data and knowledge sharing through the European industrial ecosystems.

Scope:

EU and Associated countries need to strengthen their capacity to manufacture and remanufacture goods in a sustainable and competitive way to be ready to expand into new value chains. The recent crisis has also shown the importance of resilient, flexible, reconfigurable and responsive data-driven manufacturing lines.

Projects should seize the opportunities arising from the latest state-of the art-developments in AI and robotics to deploy intelligent and autonomous systems for flexible production.

Research activities should be multi-disciplinary and address all of the following areas:

- Development of robust, easy to use, explainable and compliant AI tools for manufacturing environments that require minimal learning and can be configured without highly skilled personnel;
- Implement and integrate the latest research findings on technologies such as sensors, actuators, control, edge computing, haptic technologies, mechatronics, robotics and autonomous systems to enhance collaborative robotics systems in order to develop advanced smart manufacturing human-machine collaborative systems ensuring safe physical and social interactions and efficient collaboration with human workers;

- Demonstrate complex, safe and efficient collaboration between multiple agents simultaneously, e.g. humans, autonomous agents, industrial machinery, AGVs and collaborative robots;
- SSH should provide a variety of human-centric approaches to develop smooth collaboration in the human-machine teams; to improve user experience; and increase awareness comfort, trust, skill and safety (physical and social) of workers in highly automated industrial environments by incorporating a greater understanding of linguistic, historic, and cultural concerns of end-users and workers, while taking into consideration a gender and intersectional perspective;
- Demonstrate results in at least three large-scale industrial use-cases, targeting sectors and tasks typically difficult to automate.

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

Research must build on existing standards or contribute to standardisation. Interoperability for data sharing should be addressed. Additionally, a strategy for skills development should be presented, associating social partners when relevant.

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

In order to achieve the expected outcomes, international cooperation is encouraged, in particular with Japan and/or South Korea in view of the long cooperation with EU on AI, robotics and manufacturing.

This topic implements jointly the co-programmed European Partnerships Made in Europe and AI, Data and Robotics.

Essentials in a nutshell:

- Circa 3 project is expected to be funded, for €4-6M each
- Submission deadline: 23.9.21

Expected Outcome:

Projects are expected to contribute to the following outcomes:

- Establishing European industry as leader in sustainable manufacturing and process industries through the application of trustworthy AI technologies;
- Improving the environmental sustainability of industrial production;
- Improving the agility of European industry and its resiliency to external and internal influences;
- Integrating state-of-the-art AI technologies with advanced circular manufacturing and remanufacturing technologies and systems, exploiting their potential across the entire product and service lifecycle;

Scope:

This topic focuses on manufacturing and process industries, addressing the entire lifecycle of products and services from design to remanufacturing and including all the aspects primarily relevant for industrial production. The objective is to exploit the potential of AI as a transformation tool to support circular production in the entire manufacturing and process industry, with due consideration for standardisation activities when relevant. AI will be a strategic instrument to improve sustainability, agility and resilience to external and internal influences, taking account of the European Green Deal objectives. AI applications will be capable of optimising their actions based on limited human input, thanks to context awareness and information sensed from the physical environment, and will have the long useful lifetime typical of industrial environments.

Projects have to address the need for AI tool sets with simplified interfaces requiring only easy to acquire skills, and adapted to manufacturing environments without highly skilled personnel. Methods and tools will be provided to make AI solutions usable also for lower volume production and shorter time series, guaranteeing the quality of results even while using reduced resources for the training of AI algorithms. Generative approaches could be considered to help designing

products and processes improving the sustainability of industrial solutions. The topic will integrate new or existing technologies to make them practically and economically viable in the industrial world; this should be demonstrated through at least two realistic use cases with demonstrable economic return.

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

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

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

This topic implements jointly the co-programmed European Partnerships Made in Europe and AI, Data and Robotics. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL4-2022-DATA-01-02: Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge (RIA)

Essentials in a nutshell:

- Circa 10 projects are expected to be funded, for €4-6M each
- Submission deadline: 5.4.22

Expected Outcome:

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

- A new AI-enabled Cloud-edge framework (Cognitive Cloud) that will automatically adapt to the growing complexity and data deluge by integrating seamlessly and securely diverse computing and data environments, spanning from core cloud to edge. This framework will respond and adapt intelligently to changes in application behaviour and data variability offering automatic deployment, mobility and secure adaptability of services from cloud to edge to diverse users and contexts. Resource management should take into account the openness and trustworthiness of the underlying resource management

layers. The Cognitive Cloud will interface with all the layers in the computing continuum plane and will learn through the monitoring and management of resources deployed on Cloud/Edge. Applying AI-techniques will cater for dynamic load balancing to optimise energy efficiency and maintaining balanced data traffic and high, distributed, reliable throughput from cloud to edge according to the application and user needs and the underlying infrastructures. The framework will also dynamically adapt the processing capacity of the cloud to the varying supply of green energy in order to optimise its environmental footprint. Application developers will be empowered with greater control over network, computing and data infrastructures and services, and the end-user will benefit from seamless access to a continuous service environment.

Scope:

Highly innovation cloud management layer making the best application of artificial intelligence techniques and AI models with automatic adaptation to the computing resources (i.e., connectivity, computing & storage) in cloud and edge to optimize where data are being processed (e.g. very close to the user at the edge, or in centralised capacities in the cloud). Seamless, transparent and trustworthy integration of diverse computing and data environments spanning from core cloud to edge, in an AI-enabled computing continuum. Automatic adaptation to the growing complexity of requirements and the exponential increase of data driven by IoT deployment across sectors, users and contexts while achieving optimal use of resources, holistic security and data privacy and credibility. Interoperability challenges among computing and data platform providers should be addressed and cloud federation approaches (based on open standards, interoperability models and open platforms) should be considered where appropriate.

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

HORIZON-CL4-2021-SPACE-01-12: Future space ecosystems: on-orbit operations, new system concepts

Essentials in a nutshell:

- Circa 3 project are expected to be funded, for €1-2M each
- Submission deadline: 16.2.22

Expected Outcome:

Enable the industrialisation and new services in space by intelligent solutions and concepts, exploiting synergies with terrestrial sectors and cultivating an AppStore and Open-Architecture mentality.

Therefore, automation, robotics and artificial intelligence (AI) especially in combination with standardisation, modularisation and digitalisation are key enablers, improving space systems and satellites' flexibility and cost-efficiency, increasing sustainability and accessibility, introducing mass-customisation and cooperative design as well as simplifying operations. Each project is expected to contribute to one or several of the following outcomes:

- A future space ecosystem, fostering the industrialisation and business in space as well as supporting scientifically meaningful missions by using synergies with terrestrial sectors, building on spacecraft modularity, simplifying operations and make plug-and-play modules more common as well as enabling on-orbit services such as maintenance, assembly, manufacturing, re-configuration, recycling, logistics, warehousing, etc.
- Game-changing technologies, tools and processes enhancing on-orbit servicing applications and contribute to the protection of the in-space future ecosystem (e.g. debris mitigation).
- A paradigm shift towards sustainable, highly automated, flexible and economical viable space infrastructure, to maximise commercial opportunities in space and on Earth.

This will contribute to, in the medium to long term, developing, deploying global space-based services and contribute to fostering the EU's space sector competitiveness, as stated in the expected impact of this destination.

Scope:

The areas of R&I, which need to be addressed to tackle the above expected outcomes are:

1) R&I on new scalable satellite platform concepts and building blocks increasing the degree of satellite modularisation. Aiming at intelligent, adaptable and maintainable systems with plug-and-play compartmentalised functionalities (modules) that will introduce both, on-orbit re-configuration and re-use/re-cycling of spacecraft parts fostering debris mitigation, as well as increased system redundancy, inherently. The approach should consider an innovative, scalable and adaptive framework concept for a 'European construction kit for satellite systems and applications', following the AppStore approach and fostering development of compartmentalised functionalities (modules) for satellite systems independently from mission. The framework should address the needs from building block developers as well as from endusers. As one result, functional satellite modules (Orbital Replaceable Units to deliver new/enhanced functionality) should be

developed (TRL 5-6) to upgrade the satellite platform of the orbital demonstration mission31 by using pre-existing standard interfaces32 (plug-andplay concept). The module design should support the integration of different pre-existing standard interfaces. Further reference is given in a technical guidance document applicable to this area33.

2) R&I on new on-orbit services concepts concentrating on a next generation of potential business cases (e.g. satellite recycling, transfer services, logistics, warehousing, etc.) contributing to a sustainable space infrastructure and in-space ecosystem development. Work should include, but not be limited to, market & trend analyses, design of mission and system architecture, and feasibility studies.

3) R&I to identify, develop and implement AI and industry 4.0 means (e.g. virtual design, digital twins, virtual testing) in order to attain Rapid Development, Production and Assembly Integration and Testing (AIT) processes in satellite life cycle.

Proposals should explore relevant and promising solutions derived in Horizon 2020 activities, especially project results from the Strategic Research Clusters Space Robotics Technologies[34] and Electric Propulsion[35]. A proposal may address more than one area but must indicate the main area addressed, and is expected to promote cooperation between different actors (industry, SMEs and research institutions) and consider opportunities to quickly turn technological innovation into commercial space usage. To ensure a balanced portfolio covering the three areas described above, grants will be awarded to applications not only in order of ranking but at least also to one project that is the highest ranked within each area, provided that the applications attain all thresholds. In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

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[31] To be developed under topic HORIZON-CL4-2022-SPACE-01-11

[32] Multi-functional interface for OOS applications providing at least transfer of mechanical loads, power and data, (e.g. HOTDOCK, iSSI or SIROM)

[33] Published on the EU funding and tenders portal (https://ec.europa.eu/info/fundingtenders/opportunities/portal)

[34] http://www.h2020-peraspera.eu/

[35] https://www.epic-src.eu/

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €8-10M
- Submission deadline: 16.2.22

Expected Outcome:

Project results are expected to contribute to the following expected outcomes:

- Enhanced quality and efficiency of the current service to respond to (a) policy and/or user requirements (b) technological developments implementing the space regulation (c) complementing the challenges targeted by the Horizon Europe Mission on "Healthy oceans, seas, coastal and inland waters" and can also contribute to the initiative United Nations Decade of Ocean Science for Sustainable Development.
- Development of efficient and reliable new products chains, calling for new paradigms in data fusion, data processing and data visualisation essential for the service to handle more high-volume satellite data sets and product sets. The baseline is to preserve continuity of what has been achieved while keeping the service modern and attractive.
- Development of new algorithms and processing chains preparing the use of the new types of space observation data (being from new Sentinels or other contributing missions) in order to allow development of new products or the improvement of existing products.

Scope:

The main scope of this R&I is the development of new and innovative models for marine ecosystems monitoring and related biogeochemistry. These models will be used to prepare Copernicus-based solutions for different policies areas and for the challenges related to biodiversity conservation. Some specific domains will be the exploitation of the dynamics of the biological component of the ocean in terms of 'fauna and flora', how this marine living component behaves in relation to the ocean physics (temperature, currents, sediments), its biochemistry composition (in particular the plankton-to-fish links), climate change and the man-made pressures (e.g. transport, pollution, fisheries, etc.).

With an integrated modelling approach, the integration of new observational data becomes a driver for further enhancement and improved realism of the already existing production chains, assimilation systems and coupled models. The development of advanced processing and modelling techniques, as well as the exploitation of new sources of data, will be targeted to create new products or significantly improve the quality and performances of existing elements-

components for the benefit of users. The projects should take into account the existing service and clearly define to what extent service will be improved with new elements or products, including the use of enhanced models, algorithms, tools and techniques to generate new products.

Proposals are expected to provide tangible results (new or improved products or service elements) for the Copernicus service within the period 2021-2027. The proposed research and development should be modular and scalable. The project should provide a proof-of-concept (e.g. system element targeting TRL 5-6) at least demonstrating the feasibility of the integration in the existing core service. The activities of the project should also contribute to the objectives set by the Group on Earth Observation and outcomes and relevant results of the project should be promoted also at international level through the Global Earth Observation System of Systems (GEOSS). In addition, the project could contribute to the objectives set by the DestinE initiative and by the Marine Digital twin under development following the H2020 Green Deal call.

New technological tools should be considered and innovative solutions should be proposed for better data exploitation, processing and distribution, e.g. move to cloud and HPC computing, distributed computing, Artificial Intelligence and machine learning (e.g. for automatic feature recognition), ensemble modelling, model coupling & nesting, software as-aservice.

Additionally, the transfer of research results to possible operations should receive active attention during the course of the project to strengthen the readiness for an operational deployment in the future. Appropriate interaction with the relevant Entrusted Entity of the Copernicus services, the conditions for making available, for re-using and exploiting the

results (including IPR) by the said entities must be addressed during the project implementation. Software should be open licensed. Applicants are advised to consult information on the Copernicus programme in general at https://www.copernicus.eu/en and further details on the topic in the Guidance document243 . In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Essentials in a nutshell:

- Circa 2 project is expected to be funded, for €0.5-1M each
- Submission deadline: 16.2.22

Expected Outcome:

Commonly occurring space weather events (SWE) have the potential to affect the performance of critical space and ground infrastructure by disrupting operations and communications in multiple sectors of society. In addition, "extreme SWE" could have devastating societal and economic consequences with potential costs for disruptions and damages estimated in tens or even hundreds of billions of Euros.

Space weather technological research for new precursor services: the worldwide goal of space weather activities should be to monitor and forecast SWE just like terrestrial weather. However, direct physical simulation is currently not achievable for an operational Sun to Earth system, due in part to the lack of measurements and to the complexity of the involved

processes, as well as different timescales involved. Current space weather models are generally not capable of forecasting events over several days. A longer forecasting horizon would require access to data from new observation infrastructure coupled with new and improved modelling capabilities. Research and innovation activities should address application domains that may include space as well as terrestrial infrastructure. Proposals should include architectural concepts of possible European space weather services in relation to the application domains addressed and they should demonstrate complementarity to Space Weather services developed through the Space Situational Awareness component of the EU Space Programme.

- Prepare Europe for a full exploitation of space weather data by a renewed effort on modelling and forecasting using currently available data.
- Develop concepts to provide space weather data, forecasts and warnings with criteria on (timely) availability, harmonized (data) standards and quality control similar to the bestpractices of meteorological services (as e.g. documented by the World Meteorological Organisation WMO).
- Improve scientific understanding of the origin and evolution of space weather phenomena.
- Improving SWE restitution and prediction capabilities using artificial intelligence / deep learning techniques.

- Develop new services for both scientific purposes and terrestrial infrastructure monitoring.
- Acceleration innovation of enabling technologies (maturing, prototyping, on ground tests including exploratory ground based instrumentations research)

• Identified and matured concepts up to TRL 3-4.

Scope:

- New modelling including ab-initio simulations to understand fundamental Sun-Earth physical mechanisms and their sensitivity to parameter change for improved forecasting skills, and forecasting techniques capable of improving the restitution quality and extending the time horizon of a future space weather forecasting capability to several days.
- Proposals should address the development of modelling capabilities and/or the delivery of prototype services able to interpret a broad range of observations of the Sun's corona and magnetic field, of the Sun-Earth interplanetary space and of the Earth magneto/iono/thermo-sphere coupling relying on existing observation capacities.
- Validate and harmonize the currently available data from existing services and identify gaps in data and model availability.
- Training of models using deep-learning techniques based on existing large aggregated databases from space measurements.
- Inventory of potential early indicators of extreme space weather events.
- Complementary and coherent activities with the ESA on-going or future activities in particular those decided at the last ESA Ministerial held in November 2019.
- On ground demonstration tests.
- Ground instruments: densification of ground instrument networks and development/improvement of new instrument concepts.
- Complementary and coherent activities with existing space weather services with a significant involvement of European and national scientific institutions and stakeholders.

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

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €9M
- Submission deadline: 21.10.21

Expected Outcome:

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

- Establishing a new pillar of the European AI lighthouse.[36]
- Reinforcing a leading unified European AI community.
- Scientific progress in AI, addressing major challenges hampering its deployment.

Scope:

To ensure European open strategic autonomy in critical technologies such as AI, with huge socio-economic impact, it is essential to reinforce and build on Europe's assets in such technologies, including its world-class research community, in order to stay at the forefront of technological developments.

Europe has undeniable strengths with its many leading research centres, but the efforts are scattered.

As stated in the communication from the European Commission on Artificial Intelligence for Europe[37] and the coordinated action plan between the European Commission and the Member States and Associated Countries[38], joining forces will be crucial for international competitiveness. Europe has to scale up existing research capacities and reach a critical mass through tighter networks of European AI excellence centres. The proposals should develop mechanisms to reinforce and network excellence centres in AI, bringing the best scientists from academia and industry to join forces in addressing the major AI challenges hampering its deployment; therefore, reinforcing excellence through collaboration in AI throughout Europe.

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[36] In this section AI is taken in the broad sense and covers AI, Data and Robotics

[37] https://digital-strategy.ec.europa.eu/en/library/communication-artificial-intelligence-europe

[38] https://ec.europa.eu/commission/presscorner/detail/en/IP_18_6689

Such networks are expected to mobilise researchers to collaborate on key AI research challenges and to progress faster in joined efforts rather than working in silos, leading to fragmented and duplicated efforts. Such networks, are essential to reach critical mass and overcome the present fragmentation of AI research in Europe.

To complement and extend the initiative started in H2020 to develop a vibrant European network of AI excellence centres, and a vibrant AI scientific community, the proposals should create a network of excellence for the following topic:

Safe and secure AI addressing safety and security by design: foster the collaboration between AI with safety engineering communities, security, cybersecurity and related

communities, to develop safe-by-design and secure-by-design AI, data and robotics systems, contributing to safety and security of citizens and any users of such AI-powered systems. The focus is on research, but the work should also contribute to good practices, standards and certification, complying with regulations for AI safety and protection of fundamental rights.

Topics to be covered include, but are not limited to:

- Technical robustness and safety, incl. methods for evaluating the resilience of systems, and standardized ways of quantifying robustness of AI.
- Privacy preserving techniques and infrastructures.
- Human agency and oversight in terms of system security and safety; including explainability in human-readable terms allowing to detect/prevent/mitigate/recover from harm and threats.

Proposals will bring together the best European research teams around AI to join forces and address major technical as well as sector- or societal-driven challenges in strengthening excellence, networking, multidisciplinarity and developing academia-industry synergies, as relevant.

Composition of the Network:

- It should be driven by leading researchers in AI and AI relevant technologies from major excellent AI research centres, and bringing the best scientists across Europe, including also from promising research labs. It will bring on board the necessary level of expertise and variety of disciplines and profiles to achieve their objectives, ensuring a multidisciplinarity and multi-sectorial research approach, while respecting equality and diversity among the attracted talents.

Activities of the Network:

- In order to structure the activities, the proposals will focus on important scientific or technological challenges with industrial and societal relevance where Europe will make a difference, by building on strengths, or strengthening knowledge to fill gaps critical for Europe.
- Based on the identified challenges, the proposals will develop and implement common research agendas. The main vision and roadmap with targets within the projects, as well as methodology to implement and monitor progress will have to be specified in the proposal and can be further developed during the project.
- Scientific progress will have to be demonstrated through testing on application specific datasets or use-cases. By extending the benchmarking of foundational research to application specific areas, the research community will simultaneously address advancements in AI and grand societal and technological challenges.
- The proposals should define mechanisms to foster excellence throughout Europe, to increase efficiency of collaboration, including through networking and exchange programmes, and to develop a vibrant AI network in Europe.
- The network will disseminate the latest and most advanced knowledge to all the academic and industrial AI laboratories in Europe and involving them in collaborative projects/exchange programmes. (This could involve projects defined initially or via financial support to third parties, for maximum 20% of the requested EU contribution, with a maximum of 60k€ per third party262).
- The network will develop, where relevant, interactions with the industry, in view of triggering new scientific questions and fostering take-up of scientific advances.
- The network will develop collaboration with the relevant Digital innovation Hubs, World-class reference testing facilities, AI regulatory sandboxes and AI start-up initiatives, to disseminate knowledge and tools, and understand their needs.
- The network should also foster innovation and include mechanisms to exploit new ideas coming out of the network's work (for instance via incubators, start-up and spinoff initiatives and university tech-transfer funds).
- Overall, each proposal will define mechanisms to become a virtual centre of excellence, offering access to knowledge and serve as a reference in their chosen specific field, including activities to ensure visibility.

The proposals should:

- include mechanisms to spread the latest and most advanced knowledge to all the AI-labs in Europe.

- develop synergies and cross-fertilization between industry and academia.
- become a common resource and shared facility, as a virtual laboratory offering access to knowledge and expertise and attracting talents.
- provide broad access to AI excellence in Europe and also play an important role in increasing visibility.
- provide access to the required resources and infrastructure to support the R&D activities of the action, such as cloud and computing capacity, IoT, robotics equipment, support staff and engineers, where relevant, and the capacity to develop prototypes, pilots, demonstrators, etc.
- include a number of major scientific and application challenges which will mobilise the community to join forces in addressing them. Continuous evaluation and demonstration of scientific and technological progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring processes) towards solving the targeted challenges will motivate the entire network and support publications and scientific career developments (providing reference benchmarks to publish comparative results, using the reference data, scenarios, etc.), and also showcase the technology in application contexts, to attract more user industries and eventually foster take up and adoption of the technology.
- include mechanisms to share resources, knowledge, tools, modules, software, results, expertise, and make equipment/infrastructure available to scientists to optimise the scientific and technological progress. To that end, proposals should exploit tools such as the AI-on-demand platform263 and further develop and expand the platform, to support the network and sharing of resource, results, tools among the scientific community, maximising re-use of results, and supporting faster progress. Mechanisms to test results and continuously measure and demonstrate progress should be integrated in the platform, which is also important to support the scientific community, allowing also for comparative analysis. Openness and interoperability of components are encouraged to develop synergies and cross-fertilization between different approaches and solutions (e.g. through modularity of components or open interfaces).
- include collaboration mechanisms among the best AI and AI-relevant research teams, but also mechanisms to bring all European AI teams to the highest level of excellence. This is also in view of supporting and encouraging the adoption of AI technologies in all Member States and Associated Countries, with particular emphasis on geographical aspect and elimination of gaps in digital competences and access between Member States and Associated Countries, as well as addressing existing gender disparities.
- exploit and develop technology enablers, such as methodologies, tools and systems and exploit latest hardware development and data spaces, cloud and HPC resources.

Activities are expected to achieve TRL 4-5 by the end of the project. Proposals are expected to develop synergies:

- With other Networks of excellence centres in AI funded in H2020 or Horizon Europe, with a view of, all together, create vibrant European network of AI excellence centres. To that end, the activities should integrate with and complement the activities of the H2020-ICT-48 projects. The proposals are expected to dedicate tasks to ensure this coherence.

- With relevant activities in AI, Data and Robotics, primarily in destinations 3, 4 and 6, but also in other destinations and clusters (in particular with cluster 3 regarding securityrelated activities), and share or exploit results where appropriate.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZONCL4-2021-HUMAN-01-02.

Background

The network of excellence centres on AI safety and security will contribute to the larger objective of the European Commission to establish the European AI lighthouse.

The AI lighthouse is expected to mobilise the AI community to collaborate on key AI research challenges and to progress faster in joined efforts rather than working in silos, leading to fragmented and duplicated efforts. This is essential to reach critical mass and overcome the present fragmentation of AI research in Europe.

The lighthouse will bring together stakeholders from research, innovation and deployment, to become a world reference in AI that can attract investments and the best talents in the field. The lighthouse will build on key pillars, each of them being a network of excellence centres specialising in a given topic where Europe has the potential to become a global champion. The initiative started with the H2020-ICT-48 call establishing the first networks of excellence centres and will further develop in Horizon Europe.

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €4-9M each
- Submission deadline: 21.10.21

Expected Outcome:

Proposal results are expected to contribute to either of the following expected outcomes, depending on their focus (the proposals should focus on one of the two expected outcomes exclusively):

1. Outcome 1:

a. Efficient AI, Data and Robotics Public-Private Partnership supporting the community and the implementation of the SRIDA[39].
b. Reinforced links among initiatives in AI, Data and Robotics in H2020, Horizon Europe, Digital Europe Programme, and other programmes (Networks of excellence centres, DIHs, pilots, data platforms, and other projects).

c. Widespread educational and outreach programmes

d. Increased adoption of AI technologies in all Member States and Associated Countries, towards elimination of gaps between Member States and Associated Countries.

e. Increased adoption of trustworthy AI, data and robotics in procurement both public and private (B2B, B2C, B2G, etc.)

f. Standardisation methods for trustworthy and ethical AI to foster AI, data and robotics industry, and in support of the Commission regulatory framework.

2. Outcome 2: Efficient support to the research community via the AI-on-demandplatform[40], a public community resource.

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[39] Strategic Research, Innovation and Deployment Agenda of the AI, Data and Robotics PPP
[40] Initiated under the AI4EU project https://cordis.europa.eu/project/id/825619 and further developed in projects resulting from H2020-ICT-49-2020 call

Scope:

The proposals should address one of the following focus areas:

Focus 1) the first type of proposals (EU contribution around EUR 4.00), will address the following aspects:

- Support to the PPP on AI, Data and Robotics to develop a strong and inclusive network bringing, academia, industry, and public and industry users, including the major industrial European sectors and all relevant stakeholders, to guarantee strong coordinated efforts toward trustworthy AI, for the economy, society and environment. 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 AI. The objective is to support the community in defining and implementing the AI, Data and Robotics strategy for research, innovation, and deployment, and support the PPP in its coordination and support of the community in non-R&D tasks as well.
- Coordinate and establish links with all relevant initiatives in AI, Data and Robotics in Horizon 2020, Horizon Europe, Digital Europe Programme, and other programmes (Networks of excellence centres, DIHs, pilots, data platforms, and other projects), in view of sharing knowledge, developing synergies, and coordinate the efforts when possible. Synergies should be developed with the relevant projects through efficient mechanisms (e.g. joint task forces), organisation of joint events gathering projects, etc.
- Support and encourage the adoption of AI technologies in all Member States and Associated Countries, with particular emphasis on geographical aspect and elimination of gaps in digital competences and access between Member States and Associated Countries
- Widespread educations and outreach programmes including public awareness and addressing acceptability and trustworthiness, informing about potentialities of AI but also ensuring that 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.
- Investigate and promote the potential contribution of AI, data and robotics to social welfare and sustainability, for example as framed by the UN SDGs (sustainable development goals) and highlight the value generated by the combination of AI/data/robotics in different environments.

- Promote the adoption of trustworthy AI, data and robotics in procurement both public and private (B2B, B2C, B2G, etc.): this is crucial to foster the development of European AI industries and applications built on European data and compliant with the European regulatory framework, and to foster vast deployment of AI-based solutions.
- Support to standardisation in view of boosting AI, data and robotics industry, helping to create, and guarantee trustworthy and ethical AI, data and robotics, and in support of the Commission regulatory framework.
  o Standards should guarantee that AI, data and robotics technology in industry brings a high level of trust and safety of operations, and that it respects fundamental values and human rights. Standards should also ensure appropriate governance of AI, data and robotics throughout the system lifecycle and make sure that decision systems are trustworthy by being robust, un-biased, safe and secure.
  o Developing a coherent and broadly accepted set of AI, data and robotics standards requires a minimum level of support to ensure that all essential players are involved and that their voices are heard and in order to disseminate information and collect essential requirements. Support is also needed to coordinate and encourage contributions to standardization activities around the world.
  o An important dimension will be to explore needs for standardisation and qualification of equipment and processes, notably the application of Artificial Intelligence to business processes

The standardisation activities should include:

- The creation of an online observatory of published standards and ongoing standardisation activities in AI, data and robotics worldwide
- The identification of gaps and recommendations for key topics for future standardisation, in particular building on on-going activities in European Standardization Organizations (ESOs) and other relevant standardisation initiatives.
- Support to a mechanism for information exchange between international and European Standardization Organizations (ESOs) to increase the transparency of ongoing work at international and European levels.
- Support participation of European stakeholders in the international standardization initiatives
- Networking of all key players, collection of essential requirements for AI, data and robotics standardization and dissemination of information
- Recommendations on links between standardisation, certification and regulation
- Recommendations for research and innovation activities supporting standardization

One large CSA is expected to cover all the aspects above. Close cooperation is expected with the second CSA supporting the AI-on-demand platform.

Focus 2) the second type of proposals (EU contribution around EUR 9.00), will address the following aspects:

The second type of CSA proposals will be in charge of the maintenance and necessary developments and services provision for the AI-on-demand-platform[41], a public community resource, with a focus on supporting the research community. Such platform should support the research community in providing modules, codes, tools, knowledge base to share and continuously strengthen the S&T excellence. It should also provide the necessary access to resources (data, compute power, equipment, etc.) to offer the AI, Data and Robotics R&D community an environment in which to develop new solutions and to ensure a leading position to Europe in S&T in these fields. It should also implement methods to compare solutions, and demonstrate progress. Proposals should demonstrate how their methodology will promote excellence, by serving the needs of the scientific community. In close cooperation with the first Coordination and Support Action, it will further develop the platform services that offer a common portal gathering relevant information, success stories, etc. The activities of this AI-on-demand-platform funded through Horizon Europe will serve the needs of the research community while the AI-on-demand platform funded through the Digital Europe Programme will focuses on AI tools at higher TRLs, to serve the needs of the market. Synergies will be developed between the two platforms to ensure complementarity and avoid overlaps. Results from this platform should be transferred to the other platform, after reaching sufficient level of maturity.

This topic implements the co-programmed European Partnership on AI, Data and Robotics.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership. Proposals should include activities to collaborate with projects stemming from topics relevant to AI, Data and Robotics, primarily in destinations 3, 4 and 6 of Cluster 4, but also in other destinations and clusters, and share or exploit results where appropriate. Proposals should also develop synergies with relevant activities in Digital Europe Programme.

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

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[41] Initiated under the AI4EU project https://cordis.europa.eu/project/id/825619 and further developed in projects resulting from H2020-ICT-49-2020 call

HORIZON-CL4-2021-HUMAN-01-13: eXtended Reality Modelling (RIA)

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €4.8M each
- Submission deadline: first stage – 1.2.22, second stage – 6.9.22

Expected Outcome:

Proposals are expected to contribute to the following outcomes:

- Large-scale creation of eXtended Reality models with increased levels of interaction, context awareness, explainable autonomous decisions, human control, privacy and accessibility.
- Methodologies, tools and processes to build eXtended Reality services based on these models.
- Improved human to human and human to computer eXtended Reality interaction, in both offline and real-time context.

Scope:

Recent advances in the field of Artificial Intelligence (AI) giving machines the ability to understand and derive meaning from human languages, have shown that automatic systems can exhibit human-like performance. Machine translation, speech recognition or personal assistants are now part of our daily lives. Recent progress in AI has also enabled systems to generalise from one task to another, from one language to another, from one modality to another. Large pre-trained multilingual language models can handle different languages, even with little or no training data. The same models can cover completely different languagerelated tasks, such as text translation or summarisation, speech transcription, or sentiment analysis. Natural language Understanding and Natural Language Generation state-of-art techniques are expected to take advantage of the latest advances in research. Advances in user and environment modelling and progress in data analytics allow systems to be increasingly context-aware and efficiently support users in their decisions.

Drawing on the above-mentioned recent advances, the proposals will:

- Develop pre-trained eXtended Reality models capable of adapting to a large variety of forms of expression, interaction, languages, domains, styles and intent. Taking into account surrounding real or virtual environments, contexts, preferences and abilities of

the user, the models will contribute to the general understanding of the environments and users' knowledge, preferences, believes, abilities, intent and goals.

- Demonstrate the adaptation and generalisation of the eXtended Reality models, including through the integration of structured knowledge, by developing solutions capable of carrying genuine human-like interaction before, during and after an eXtended Reality experience.
- Integrate the solutions into several eXtended Reality use-cases scenarios, such as media, collaborative telepresence, learning, personal assistants or information retrieval.

Beyond supporting a large set of languages and modalities, the work will focus on enabling new forms of interactions, avoiding bias, whilst ensuring accessibility, privacy, transparency and explainability.

To compensate the increase of model complexity, the proposed solutions should be energy efficient thanks to optimised protocols and algorithms with equivalent performance during both training and implementation.

The proposal will ensure reproducibility and repeatability of the research results, promote an open data and interfaces standardisation, avoiding narrow de-facto standards and demonstrate clear and efficient integration paths for the European industry take up.

To further extend the application domains, address sector specific constrains, ensure reproducibility and demonstrate their integration paths, proposals are expected to organise a number of competitive calls with financial support to third parties (FSTP) and further extend the use-cases. At least 20% of the funding should be dedicated to FSTP. To that aspect, the consortium will provide guidelines and technical support in engineering integration, testing and validation to support the development of such use-cases.

HORIZON-CL4-2021-HUMAN-01-26: Workforce skills for industry 5.0 (RIA)

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €5M
- Submission deadline: 21.10.21

Expected Outcome:

Proposals are expected to contribute to the following outcomes:

- A quantitative and qualitative assessment of the nature of job transformations in the context of the 4th industrial revolution, estimating and mapping the emerging occupations. Establishment of an "Industry 5.0 platform" for future skill requirements improving the critical understanding of the 'black box' of new jobs creation;
- guidance and recommendations, including avenues for new learning and training systems, for policy-makers, businesses, individuals, to reduce the skills' gaps, to cope with possible unemployment effects, to foster industrial competitiveness while enhancing inclusiveness.

Scope:

The 4th industrial revolution, has been associated with production efficiencies, cost reductions, streamlined labour requirements and business model adaptations. However, this is accompanied with social, economic and organizational challenges such income inequalities, public perception for job quality and scarcity, legal issues and data security. The RIA will investigate the social and economic impacts generated by emerging disruptive technologies (artificial intelligence & machine learning, block chain, big data, internet of things, 5g, etc.), robotisation and digitalization on labour markets and business models. They will explore innovative methodologies in redefining work activities and automatable tasks also through an historical comparison with previous industrial revolutions, including cultural, ethical, and regional perspectives, combining the tools of social sciences and humanities (SSH) disciplines with the insights of industry leaders (large companies, SMEs, regional ecosystems) and social partners. Several dimensions should be explored: job nature and skills including the impact generated by the covid-19 outbreak, labour productivity, employment and mobility, quality and new forms of work, business value chains, management and organisational models, gender aspects, workplace and socio-demographic characteristics, territorial structures. Proposals will comprehensively assess how benefits are distributed in all sectors and, keeping into account similar ongoing exercises (e.g. OECD, CEdefop, etc..) as well as national industry 5.0 initiatives, they will forecast the expected dominant trend of jobs, mapping the emerging occupations and predicting the future skill needs and shifts by industry, also improving the critical understanding of those which cannot be automated (creativity, social intelligence, problem-solving, etc..).

Furthermore distinctive learning trajectories and training paths will be identified for both STEM and soft skills, including combined public-private learning ecosystems and collaborative learning techniques/tools. Skills taxonomies will be developed in order to monitor track changes in the demand that are continually challenged by technological progress, thus contributing to close unintended skill gaps and unemployment spill-overs.

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

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

HORIZON-CL4-2022-HUMAN-01-02: European Network of AI Excellence Centres: Expanding the European AI lighthouse (RIA)

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €11.5M each
- Submission deadline: 5.4.22

Expected Outcome:

Proposals results are expected to contribute to all the following expected outcomes:

- Scientific progress in AI, addressing major challenges hampering its deployment.
- Establishing a new pillars of the European AI lighthouse[42]
- Reinforcing the leading unified European AI community

Scope:

To ensure European open strategic autonomy in critical technology such as AI, with huge potential socio-economic impact, it is essential to reinforce and build on Europe's assets in such technologies, including its world-class researcher community, in order to stay at the forefront of technological developments.

As stated in the communication from the European Commission on Artificial Intelligence for Europe and the coordinated action plan between the European Commission and the Member States, while Europe has undeniable strengths with its many leading research centres, efforts are scattered. Therefore joining forces will be crucial to be competitive at international level. Europe has to scale up existing research capacities and reach a critical mass through tighter networks of European AI excellence centres. The proposals should develop mechanisms to reinforce and network excellence centres in AI, bringing the best scientists from academia and industry to join

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[42] In this section AI is taken in the broad sense and covers AI, Data and Robotics

forces in addressing the major AI challenges hampering its deployment, and to reinforce excellence in AI throughout Europe via a tight network of collaboration.

Such networks are expected to mobilise researchers to collaborate on key AI topics and to increase the impact of the funding in progressing faster in joined efforts rather than working in isolation, with fragmented and duplicated efforts. Such networks, together with other mechanisms, will play an important role in reaching critical mass and in overcoming the present fragmentation of AI research in Europe.

Proposals will mobilise the best European teams in AI community to join forces to address major technical as well as sector- or societal-driven challenges: strengthening excellence, networking, multidisciplinarity, academia-industry synergies.

This initiative contributes to the initiative started in H2020 to develop a vibrant European network of AI excellence centres, and a vibrant AI scientific community, and continued in the first call of Horizon Europe. To complement and extend this initiative the proposals should create a network of excellence for the following topics:

1. Next Generation AI – covering foundational research and emerging and novel approaches, with a view of improving the technical performances of AI-based systems, such as increased accuracy, robustness, verifiability, dependability, adaptability, versatility, graceful degradation, etc. Research is also expected to address functional and performance guarantees. Aspects to be covered include, but are not limited to: foundational research in artificial intelligence and machine learning including new paradigms, algorithms, architectures and novel optimization and regularization methods, hybrid AI, hybrid machine learning, data/sample –efficiency.

2. Scientific research and technologies prioritised in the latest SRIDA (Strategic Research, Innovation and Deployment Agenda of the AI, Data and Robotics PPP) , and complementing the previously selected Networks of Excellence centres (either in H2020-ICT48, or the first calls for Networks of Excellence Centres in Horizon Europe).

The selected proposals will maximise the coverage of the portfolio of networks of excellence centres in AI. Composition of the Networks:

- Proposals should be driven by leading researchers in AI and AI relevant technologies from major excellent AI research centres, and bringing the best scientists across Europe, including also from promising research labs. They will bring on board the necessary level of expertise and variety of disciplines and profiles to achieve their objectives, ensuring a multidisciplinarity and multi-sectorial research approach, while respecting equality and diversity among the attracted talents.

Activities of the Networks:

- In order to structure the activities, the proposals will focus on important scientific or technological challenges with industrial and societal relevance where Europe will make a difference, by building on strengths, or strengthening knowledge to fill gaps critical for Europe.
- Based on the identified challenges, the proposals will develop and implement common research agendas. The main vision and roadmap with targets within the projects, as well as methodology to implement and monitor progress will have to be specified in the proposal and can be further developed during the project.
- Scientific progress will have to be demonstrated through testing on application specific datasets or use-cases. By extending the benchmarking of foundational research to application specific areas, the research community will simultaneously address advancements in AI and grand societal and technological challenges.
- The proposals should define mechanisms to foster excellence throughout Europe, to increase efficiency of collaboration, including through networking and exchange programmes, and to develop a vibrant AI network in Europe.
- Each network will disseminate the latest and most advanced knowledge to all the academic and industrial AI laboratories in Europe and involving them in collaborative projects/exchange programmes. (This could involve projects defined initially or via financial support to third parties, for maximum 20% of the requested EU contribution, with a maximum of 60k€ per third party[43]).
- Each network will develop, where relevant, interactions with the industry, in view of triggering new scientific questions and fostering take-up of scientific advances
- Each network will develop collaboration with the relevant Digital innovation Hubs and AI start-up initiatives, to disseminate knowledge and tools, and understand their needs.
- These networks should also foster innovation and include mechanisms to exploit new ideas coming out of the network's work (for instance via incubators).
- Overall, each proposal will define mechanisms to become a virtual centre of excellence, offering access to knowledge and serve as a reference in their chosen specific field, including activities to ensure visibility

The proposals should

- include mechanisms to spread the latest and most advanced knowledge to all the AI-labs in Europe
- develop synergies and cross-fertilization between industry, academia and civil society.

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[43] Maximum amount per third party, received from a given Action, over its entire duration

- become a common resource and shared facility, as a virtual laboratory offering access to knowledge and expertise and attracting talents
- provide broad access to AI excellence in Europe and also play an important role in increasing visibility
- provide access to the required resources and infrastructure to support the R&D activities of the action, such as cloud and computing capacity, IoT, robotics equipment, support staff and engineers, where relevant, and the capacity to develop prototypes, pilots, demonstrators, etc.
- include a number of major scientific and application challenges which will mobilise the community to join forces in addressing them. Continuous evaluation and demonstration of scientific and technological progress (with qualitative and quantitative KPIs, benchmarking and progress monitoring processes) towards solving the targeted challenges will motivate the entire network and support publications and scientific career developments (providing reference benchmarks to publish comparative results, using the reference data, scenarios, etc.), and also showcase the technology in application contexts, to attract more user industries and eventually foster take up and adoption of the technology.
- include mechanisms to share resources, knowledge, tools, modules, software, results, expertise, and make equipment/infrastructure available to scientists to optimise the scientific and technological progress. To that end, proposals should exploit tools such as the AI-on-demand platform[44] and further develop and expand the platform, to support the network and sharing of resource, results, tools among the scientific community, maximising re-use of results, and supporting faster progress. Mechanisms to test results and continuously measure and demonstrate progress should be integrated in the platform, which is also important to support the scientific community, allowing also for comparative analysis. Openness and interoperability of components are encouraged to develop synergies and cross-fertilization between different approaches and solutions (e.g. through modularity of components or open interfaces)
- include collaboration mechanisms among the best AI and AI-relevant research teams, but also mechanisms to bring all European AI teams to the highest level of excellence. This is also in view of supporting and encouraging the adoption of AI technologies in all Member States and Associated Countries, with particular emphasis on geographical aspect and elimination of gaps between Member States/Associated Countries, as well as addressing existing gender disparities.

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[44] Initiated under the AI4EU project https://cordis.europa.eu/project/id/825619 and further developed in projects resulting from H2020-ICT-49-2020 call

- exploit and develop technology enablers, such as methodologies, tools and systems and exploit latest hardware development and data spaces, cloud and HPC resources.

These networks will also address a number of sector- or societally-driven challenges, mobilising the community towards achieving common goals in addressing such challenge that AI can help solving, demonstrating the potential positive impact on the society, economy and environment.

Activities are expected to achieve TRL 4-5 by the end of the project.

Proposals are expected to develop synergies:

- With other Networks of excellence centres in AI funded in H2020 or Horizon Europe, with a view of, all together, create vibrant European network of AI excellence centres. To that end, the activities should integrate with and complement the activities of the H2020-ICT-48 projects. The proposals are expected to dedicate tasks to ensure this coherence.
- With relevant activities in AI, Data and Robotics, primarily in destinations 3, 4 and 6, but also in other destinations and clusters (in particular with cluster 3 regarding securityrelated activities), and share or exploit results where appropriate.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZONCL4-2021-HUMAN-01-02.

Background

The selected network(s) of excellence centres will contribute to the larger objective of the European Commission to establish the European AI lighthouse.

The AI lighthouse is expected to mobilise the AI community to collaborate on key AI research challenges and to progress faster in joined efforts rather than working in silos, leading to fragmented and duplicated efforts. This is essential to reach critical mass and overcome the present fragmentation of AI research in Europe.

The lighthouse will bring together stakeholders from research, innovation and deployment, to become a world reference in AI that can attract investments and the best talents in the field. The lighthouse will build on key pillars, each of them being a network of excellence centres specialising in a given topic where Europe has the potential to become a global champion.

HORIZON-EUSPA-2021-SPACE-02-53: EGNSS applications for the Digital Age

Expected Outcome:

Projects are expected to contribute to the following outcomes:

- Foster the adoption of EGNSS in mass markets and professional markets.
- Create applications that will make the best use of EGNSS innovative features such as better multipath resistance, authentication etc.
- Contribute to the competitiveness of the European GNSS industry in the area of mobile applications, with special focus on the innovative role of SMEs and midcaps, and nonspace countries.
- maximise public benefits by supporting the development of EGNSS applications that will address major societal challenges in focus areas such as health, citizen safety and security, mobility and the sharing economy.

Scope:

Proposals may be submitted in any of the following areas:

- Internet of Things: Within Internet of Things solutions, there is a clear trade-off in terms of accuracy and battery life that prevents users to rely on GNSS in any situation. EGNSS solutions should demonstrate how power reduction techniques can effectively deliver GNSS-level accuracy in IoT devices and develop IoT solutions able to demonstrate the EGNSS compositeness in the IoT domain, to be used in application fields such as food geo traceability, blockchain and Artificial Intelligence
- Mobile solutions. Development of new EGNSS enabled solutions which exploit the EGNSS differentiators such as High Accuracy Service and authentication features or which leverage the availability of GNSS raw measurements in smartphones.
- mHealth-solutions for 'silver economy', robotics. With the ageing population growing fast in the EU, governments will be increasingly challenged to meet the needs of older people in a cost-effective manner. EGNSS can support the 'silver economy' by satisfying the specific needs of elderly and disabled persons. The innovations brought by EGNSS, together with technologies such as robotics or enhanced home automation – should be exploited to develop innovative solutions.
- Artificial intelligence- Big Data, geo-tagging, optimisation for multiple sensors. Advances in AI will improve the capabilities of applications and services, providing improved experiences to all users.AI-enabled machine learning can be used to improve the GNSS data processing to provide greater performance thanks to the optimisation of multiple

sensors. Proposals should explore synergies between EGNSS and Artificial Intelligence, in the frame of applications relaying on big data and geo-tagging techniques. Synergies with earth observation data can be also exploited.

- Cybersecurity- solutions that are stimulating privacy, security of location data, exploiting synergies with quantum. In a digitalised world, privacy and cybersecurity are of utmost importance for individuals who are increasingly relying on digital applications to perform day-to-day task and activities. EGNSS solutions should enhance the security of location-based applications. Additionally, synergies with quantum can be leveraged as well.

- Sharing economy- solutions for logistics, mobility services, goods and food. The sharing economy covers many different sectors. It is rapidly emerging across Europe. Within this trend, GNSS is a key technology for all services requiring geographic information. Newly developed EGNSS solutions in the field of logistics, mobility services, and food industry should capitalise on the enhanced accuracy and the innovative features provided by EGNSS.

- Sports and fitness - smart wearables. Wearables represent the beginning of the separation between smartphones and end users, as an increasing number of smartphone services and apps are now accessible via new interfaces (smartwatches, fitness trackers, smart glasses, clothing, etc.). Currently, wearables are mostly used for fitness, health and entertainment. Proposals should ensure the use of EGNSS innovative features and differentiators in the smart wearables domain, integrating also other non-space technologies.

Synergies with other space components and other non-space technologies are applicable to this topic.

The developed applications should have a clearly defined commercial potential and should respond to user needs. Standardisation of new technologies is also in the scope of the topic and might be considered by the applicant. The solution developed is expected to achieve TRL7-9 by the end of the project.

Proposals should deliver new innovative applications, with commercial and social benefits, impact and a clear market uptake. The standardisation of new technologies is also in the scope of the topic and might be considered by the applicant. The use of other space components such as Copernicus is highly encouraged. The developed solutions may integrate other non-space technologies like IoT, big data, artificial intelligence, drones, 5G, augmented/mixed reality etc.

For proposals under this topic:

- Participation of industry, in particular SMEs and midcaps, is encouraged;

- Participation of, or outreach to ,entities based in countries without a space tradition is encouraged;
- Involvement of post-graduate researchers (engineers, scientists, and others) is also encouraged, for example through professional work experience or through fellowships/scholarships when applicable;
- A Business Plan and evidence of user engagement iscompulsory and must be provided as part of the proposal, to demonstrate the user need and sustainability of the project.
- Proposals addressing PRS (Public Regulated Service) related applications are not in the scope of this action. Applicants are advised to exploit all possible synergies with other security specific actions funded under the work programme of Cluster 1 "Health", other parts of Cluster 4 "Digital, Industry and Space", and Cluster 5 "Climate, Energy and Mobility" (e.g. destinations 5 and 6). Proposals under this topic should exploit synergies and be complementary to national activities and activities funded by ESA. Applicants are welcome to use the European space data infrastructures, e g. Galileo Service Centre, EGNOS Data Access Service (EDAS) and the EGNOS user support facilities (ASQF).

HORIZON-CL4-2021-DATA-01-03: Technologies for data management (AI, Data and Robotics Partnership) (IA)

Essentials in a nutshell:

- Circa 6 projects are expected to be funded, for €5M each
- Submission deadline: 21.10.21

Expected Outcome:

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

- provide new secure and energy-efficient data management tools improving the usability and discoverability of data in different contexts, covering data provenance, synthetic data generation, data quality management (such as data cleaning, validation, enrichment, co-creation, identification of bias and correlations), improving data interoperability, metadata management (automated ways of labelling and describing data, data linkage), and ensuring data security, privacy and integrity, especially in the context of data spaces.

Scope:

The actions under this topic are expected to provide practical, robust and scalable tools to improve the interoperability, quality, and integrity of data and metadata, in the context of other topics of the heading "Data sharing in the common European data space". The data management tools and systems should support a holistic approach of the data life cycle and comply with accountability, fairness and confidentiality as well as the FAIR principles (Findable, Accessible, Interoperable, Reusable) for data and metadata management. Building on results of relevant past and current initiatives, data management tools, systems and processes are expected to enable, support and/or automate the creation and maintenance of common ontologies, vocabularies and data models and/or structured, standardised and automated authoring, co-creation, curation, annotation and labelling of data, in view of different later uses (especially AI) made of the data. The actions are expected to create links with relevant initiatives collecting/using heterogeneous/linguistic data, including AI initiatives (such as AI4EU, European Language Grid, or the projects from the H2020 topic ICT-48), and liaise with standardization bodies, where appropriate.

Actions are expected to deal with gaps and needs identified in real-world data space management and real-world data heterogeneity challenges (encoding formats, multiple languages, collection mechanisms, access methods, etc.), supporting, where necessary, hybrid/adaptive approaches and models, leading to robust, reliable and automated annotation of unstructured data sources. The tools should contribute to minimization of the energy footprint, be adaptable to different user needs and support and encourage new business models and (where appropriate) citizen involvement and social innovation. The tools should be demonstrated by diverse use cases. Provision of open source tools is encouraged to contribute to outreach and impact.

In this topic the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement. This topic implements the co-programmed European Partnership on Artificial Intelligence, Data and Robotics.

Essentials in a nutshell:

- Circa 10 projects are expected to be funded, for €4-6M each
- Submission deadline: 5.4.22

Expected Outcome:

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

- A new AI-enabled Cloud-edge framework (Cognitive Cloud) that will automatically adapt to the growing complexity and data deluge by integrating seamlessly and securely diverse computing and data environments, spanning from core cloud to edge. This framework will respond and adapt intelligently to changes in application behaviour and data variability offering automatic deployment, mobility and secure adaptability of services from cloud to edge to diverse users and contexts. Resource management should take into account the openness and trustworthiness of the underlying resource management layers. The Cognitive Cloud will interface with all the layers in the computing continuum plane and will learn through the monitoring and management of resources deployed on Cloud/Edge. Applying AI-techniques will cater for dynamic load balancing to optimise energy efficiency and maintaining balanced data traffic and high, distributed, reliable throughput from cloud to edge according to the application and user needs and the underlying infrastructures. The framework will also dynamically adapt the processing capacity of the cloud to the varying supply of green energy in order to optimise its environmental footprint. Application developers will be empowered with greater control over network, computing and data infrastructures and services, and the end-user will benefit from seamless access to a continuous service environment.

Scope:

Highly innovation cloud management layer making the best application of artificial intelligence techniques and AI models with automatic adaptation to the computing resources (i.e., connectivity, computing & storage) in cloud and edge to optimize where data are being processed (e.g. very close to the user at the edge, or in centralised capacities in the cloud). Seamless, transparent and trustworthy integration of diverse computing and data environments spanning from core cloud to edge, in an AI-enabled computing continuum. Automatic adaptation to the growing complexity of requirements and the exponential increase of data driven by IoT

deployment across sectors, users and contexts while achieving optimal use of resources, holistic security and data privacy and credibility. Interoperability challenges among computing and data platform providers should be addressed and cloud federation approaches (based on open standards, interoperability models and open platforms) should be considered where appropriate.

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

HORIZON-CL4-2021-DIGITAL-EMERGING-01-01: Ultra-low-power, secure processors for edge computing (RIA)

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €8-10M each
- Submission deadline: 21.10.21

Expected Outcome:

Proposals are expected to contribute to the following outcomes:

- Develop European secure specialised microprocessor designs (including accelerators and controllers) that deliver high-performance computing at ultra-low power operation.
- Improve by at least two orders of magnitude the performance per watt for the targeted edge applications.

Scope:

- Develop European specialised processors, architectures and computational engines that have the potential to substantially improve energy efficiency (i.e. performance per watt) for the targeted edge application.
- Examples of targeted applications (non-exhaustive list) are automated driving, artificial intelligence, machine learning, computer vision, machine translation, speech recognition, sensor fusion, signal processing, etc.
- New specialised processor designs may incorporate approaches such as neuromorphic, in-memory computing, probabilistic computing, neural networks, programmable logic, hardware-software co-design as well as open-source hardware and processor IP.
- Proposals should have a longer-term perspective taking into account the reduced performance improvements of general-purpose computing, the slow-down of Moore's law and the changing economics of semiconductor manufacturing.

- Proposals should include research on advanced hardware-based security at silicon-level.
- Proposals should take into account certification guidelines for secure and safety-critical applications where relevant. Proposals should include a preliminary analysis of bringing successfully to the market the proposed research either as IP blocks or as standalone chips. Proposals may include early chip prototyping in well-justified cases.

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

HORIZON-CL4-2021-DIGITAL-EMERGING-01-09: AI, Data and Robotics for the Green Deal (AI, Data and Robotics Partnership) (IA)

Essentials in a nutshell:

- Circa 7 projects are expected to be funded, for €3-5M each
- Submission deadline: 21.10.21

Expected Outcome:

Proposal results are expected to contribute to at least one of the following expected outcomes:

1. Innovative AI, data and robotics solutions for resource optimisation and minimisation of waste in any type of sector (from agri-food, to energy, utilities, transport, production, etc.), reduction of energy consumption and greenhouse gas emissions including exploitation of all data and information sources contributing to optimising applications for a greener planet. This includes among others contribution to enterprises' sustainability programs in the context of their CSR (Corporate Social Responsibility) strategies to reduce their ecological footprint, cutting costs and contributing to social welfare at the same time
2. Optimised AI, data and robotics (including modular and adaptive solutions) to maximise contribution to the Green Deal in various applications such as environmental and waste management, including for instance waste clean-up (e.g. plastic collection, sorting), or in the circular economy value chain.
3. Advanced physical intelligence and physical performance of robotics solutions in diverse harsh environments serving the Green Deal.

Scope:

Proposals are expected to integrate and optimise AI, data and robotics solutions in order to demonstrate, by addressing use-cases scenarios in actual or highly realistic operating environments, how they can directly contribute to the Green Deal. The proposed methodology should be supported by industry or service relevant KPIs, making the case for the added value of such technologies, and demonstrating scalability, and deployment potential. Technology performance as well as added value to the application field should be demonstrated by qualitative and quantitative KPIs, demonstrators, benchmarking and progress monitoring. The environmental impacts of the proposed solutions should also be taken into account when making the case for the added value of the technology for the environment.

While the proposals must be application driven, involving problem owners to define needs and validate the proposed solutions, the focus is on optimising enabling AI, data and robotics

echnologies to maximise the benefit they bring in such applications. Proposals should adopt a concrete problem solving approach, exploiting and optimising the most suitable technologies and solutions at hand. The focus should be on real-world scenarios, which can benefit in short to mid-term from the technology and solutions and demonstrate substantial impact on the Green Deal, while taking into account the maturity of the technologies to solve the problems at hand.

Deep involvement of all relevant stakeholders (including SMEs), from technology providers to user industry, social partners, and relevant experts in operational and environmental impact assessment, will be essential. Special attention will be given to including users of diverse age, gender and background.

All proposals should incorporate training programs for non-expert users of AI, data and robotics systems, who are domain experts and need to know basic AI, data, robotics concepts, including the basics concepts of Trustworthy and ethical AI.

To reach their objectives, all proposals are expected to exploit synergies between at least two of the three components: AI, Data and Robotics and forge strong cooperation between to corresponding practitioners.

Proposals can involve either robotics-only solutions (for instance demonstrating robotics solutions in harsh environments), or a mix of robotics and non-robotics components (for instance in applications such as waste management, where a combination of robotics for waste segregation and data and sensor driven AI for process optimisation) or only include non-robotics AI and Data (for instance in energy optimisation, from production sites, through the network, and then end-user sites, with IoT components). All selected proposals are expected to include demonstrators at TRL 6 or above. At least half of the selected proposals will have to have a major

robotics demonstrator; therefore, proposals should clearly specify their robotics demonstrator, if they chose to have one.

Proposals should clearly identify the expected outcome it will focus on.

Two types of proposals are expected:

1. Focused projects (EU contribution around EUR 3.00 million), involving the user industry and technology provider(s),

2. Larger projects (EU contribution around EUR 5.00 million), where a number of companies in a given application sector will identify in the proposal common challenges and use-cases, and organise competitive calls for AI, data and robotics solution providers to address such challenges. Competitive calls will be open to all types of companies, but only SMEs and Start-ups[45] will receive financial support to third parties, with a maximum of EUR 200 000 per third party[46] and 70% funding (100% for start-ups). At least 40% of the requested amount should be dedicated to financial support to third parties. The consortium will provide technical support with expertise in engineering integration, testing and validation to support the selected SMEs and start-ups acting as technology providers to demonstrate the added value of their solutions to address the challenges of the use-cases. Maximum one type of third party project will be funded per expected outcome.[47]

In all proposals, user industries are expected to play a major role in the requirement and validation phases.

Besides financial support, these SMEs and start-ups successfully demonstrating the potential of their solutions, must receive support from business experts, provided by the action, to further develop their business and develop their market reach, and maximise their business opportunities.

When possible, proposals should build on and reuse public results from relevant previous funded actions. Proposals should make use of connections to the Digital Innovation Hub networks, particularly those in Robotics, Data and AI. Full use should be made of the common resources

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[45] In this context a start-up is a tech-oriented company. It should employ less than 10 people (but more than 2 full time equivalent staff) that has operated for less than three years and has attracted more than EUR €50 000 early stage private sector investment or has demonstrable sales growth over 50% pa – they will receive 100% financial support to third parties while other SMEs would receive 70% financial support. Startups would be expected to highlight the impact that the project will have on their overall

[46] Maximum amount per third party, received from a given action, over its entire duration

[47] The 3 expected outcomes are : 1. Resource optimisation and minimisation of waste, energy or greenhouse gas emissions, 2. Environmental and waste management in the circular economy, 3. Robotics solutions in harsh environments serving the Green Deal

available in the AI-on-Demand platform[48], Digital Industrial Platform for Robotics[49], data platforms[50] and, if necessary other relevant digital resource platforms. Communicable results from selected proposals should be delivered to the most relevant of these platforms in order to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

If proposals use satellite-based earth observation, positioning, navigation and/or related timing services and data, they have to prioritise Copernicus and/or Galileo/EGNOS over equivalent competing solutions offering the same services/data.

All proposals are expected to allocate tasks to cohesion activities with the co-programmed partnership on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZON-CL4-2021-HUMAN-01-02.

Where relevant, synergies with other European partnerships and Horizon Europe Clusters (Cluster 4 and Cluster 6 in particular) are encouraged.

This topic implements the co-programmed European Partnership on Artificial Intelligence, Data and Robotics.

HORIZON-CL4-2021-DIGITAL-EMERGING-01-10: AI, Data and Robotics at work (AI, Data and Robotics Partnership) (IA)

Essentials in a nutshell:

- Circa 6 projects are expected to be funded, for €3-5M each
- Submission deadline: 21.10.21

Expected Outcome:

Proposal results are expected to contribute to at least one of the following expected outcomes:

- A new human-centred paradigm to keep people away from unsafe and unhealthy jobs via collaborative embodied (physical) AI, engaging and empowering end-users and workers, regardless of their gender, age or background.

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[48] Initiated under the AI4EU project https://cordis.europa.eu/project/id/825619 and further developed in projects resulting from H2020-ICT-49-2020 call
[49] https://robmosys.eu/newsrobmosys-rosin-towards-an-eu-digital-industrial-platform-for-robotics/
[50] https://www.big-data-europe.eu/

- Human-centric AI supporting professionals in trustworthy hybrid decision-making, and optimising their tasks

Scope:

Proposals are expected to demonstrate how AI, data, robotics and automation solutions can support workers in their daily tasks, improving working conditions (both physical and social) and work performance/efficiency, while considering safety, security and resilience, as appropriate. The added value to the application field should be demonstrated by qualitative and quantitative industry/production or service relevant KPIs, demonstrators at TRL6-7, benchmarking and progress monitoring processes.

The involvement of the application sector stakeholders, including social partners, workers, managers and decision makers must be a key driver in the proposals, not only to identify the needs and the application scenarios, but to be involved in the co-creation and testing and uptake of the solutions and providing feedback to adapt the solutions to optimise the impact on working conditions and performances.

The selection of the application sector should prioritise sectors and use-cases where the technology can demonstrate maximum impact and added value.

While the focus is on technology, a human-centred approach will be key, with involvement of the workers, professionals, (front-line operators and managers) and other relevant experts, such as experts in human-centred design. They will closely collaborate with the technology providers and integrators. Engagement with SSH[51] expertise is also needed to improve interaction design and to provide expertise on trustworthiness and acceptability by workers, as well as ethical perspective of human-machine collaboration. Gender and intersectionality dimension[52] analysis should be a part of the proposals, where relevant.

Two types of proposals are expected:

1. Focused projects (EU contribution around EUR 3.00 million), involving the user industry and technology provider(s),
2. Larger projects (EU contribution around EUR 5.00), where a number of companies in a given application sector will identify in the proposal common challenges and use-cases, and organise competitive calls for AI, data and robotics solution providers to address such challenges.

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[51] Social Sciences and Humanities
[52] https://en.wikipedia.org/wiki/Intersectionality - intersectional aspects could cover gender, age, social level, education, ethnic origin, etc.

Competitive calls will be open to all types of companies, but only SMEs and Start-ups[53] will receive financial support to third parties, with a maximum of EUR 200 000 per third party[54] and 70% funding (100% for start-ups). At least 40% of the requested amount should be dedicated to financial support to third parties. The consortium will provide technical support with expertise in engineering integration, testing and validation to support the selected SMEs and start-ups acting as technology providers to demonstrate the added value of their solutions to address the challenges of the use-cases. Maximum one type of third party project will be funded per use-case.

In all proposals, user industries are expected to play a major role in the requirement and validation phases.

Besides financial support, these SMEs and start-ups successfully demonstrating the potential of their solutions, must receive support from business experts, provided by the action, to further develop their business and develop their market reach, and maximise their business opportunities.

When possible, proposals should build on and reuse public results from relevant previous funded actions. Proposals should make use of connections to the Digital Innovation Hub networks, particularly those in Robotics, Data and AI. Full use should be made of the common resources available in the AI-on-Demand platform[55], Digital Industrial Platform for Robotics[56], data platforms[57] and, if necessary other relevant digital resource platforms. Communicable results from projects should be delivered to the most relevant of these platforms in order to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZONCL4-2021-HUMAN-01-02. Where relevant, synergies with other PPPs are encouraged.

This topic implements the co-programmed European Partnership on Artificial Intelligence, Data and Robotics.

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[53] In this context a start-up is a tech-oriented company. It should employ less than 10 people (but more than 2 full time equivalent staff) that has operated for less than three years and has attracted more than EUR €50 000 early stage private sector investment or has demonstrable sales growth over 50% pa – they will receive 100% financial support to third parties while other SMEs would receive 70% financial support. Startups would be expected to highlight the impact that the project will have on their overall Company strategy and growth prospects in the Impact section of their proposals (as well as the impact on society and European competitiveness

[54] Maximum amount per third party, received from a given action, over its entire duration

[55] Initiated under the AI4EU project https://cordis.europa.eu/project/id/825619 and further developed in projects resulting from H2020-ICT-49-2020 call

[56] https://robmosys.eu/newsrobmosys-rosin-towards-an-eu-digital-industrial-platform-for-robotics/

[57] https://www.big-data-europe.eu/

Essentials in a nutshell:

- Circa 9 projects are expected to be funded, for €5M each
- Submission deadline: 21.10.21

Expected Outcome:

Proposal results are expected to contribute to the following expected outcome:

- New generation of AI-Powered Robotics: Enabling robots to have more profound impacts than they currently have, in powering them with a deeper kind of AI, endowing them with a better perception and understanding of the world (up to semantic and explainable representations), This would allow the next generation of autonomous robots, with increased capabilities to work without/with limited supervision, as well as the next generation of interactive robots, with greatly improved intuitive, safe and efficient cognitive, social and physical capabilities, to assist humans.

In addition, depending on the focus of the proposal, the results are expected to contribute to at least one of the following expected outcomes

- Smarter robots with improved capabilities, functionalities (including complex functionalities such as manipulation of delicate, irregular, dynamic or deformable objects, navigation in un-controlled and variable or challenging and harsh environments, and continuous human-physical interactions) and an increased level of autonomy over the current state of the art, necessary to address real-world problems, while ensuring safety and reliability.
- Smooth and trustworthy (including safety and reliability) human-robot collaboration through advanced reactivity and mutual understanding, and human-centric automated adaptation of robots in human-robot interactions.

Scope:

Proposals are expected to develop technologies and systems that significantly enhance the cognitive ability of robots from the current state of the art to achieve greater levels of interaction and autonomy. Proposals will address as appropriate the following:

- Develop enabling technologies, both new and existing, that extend the current state of the art in robotics perception, cognition, interaction and action as well as develop novel or advanced tools for the design and configuration of robots and robot systems that speed up the process of integration thereby reducing the time taken to deploy robot solutions. To do so by addressing the modularity and composability of solutions both in the operational context of a wide range of action and interaction use cases.
- There is also a need to address concepts such as trustworthiness, privacy, security and ethics already at the technology design phase.
- Develop lifelong autonomous robotics able to tackle unknown situations and adapt in the long term in pushing the state of the art of AI-based robots that combine monitoring, learning, planning and acting in order to evolve in difficult environments over long period of time. Support from simulation tools could be considered, as appropriate.
- Increase robot acceptance by handling adequately both human and robotic actions, with human-centric, advanced behavioural and elaborated planning models, and adopting multidisciplinary approaches including SSH[58], as well as end-user involvement in the design of solutions addressing human factors and interaction. Gender and intersectionality dimension[59] analysis should be a part of the proposals, where relevant.
- Push the limits of robotics interaction, adopting an interdisciplinary approach to integrate methods and techniques that allow the machines to engage in physical interactions with people or the environment, safely and intelligently, through specific enabling technologies: intuitiveness and responsive human-robot interfaces; integration of robot perception with natural and artificial intelligence; ability to physically, stably, dependably and safely interact with the environment, including users and surrounding people; development of advanced control tools fully integrating the human in the loop when performing a task; development of advanced control tools for dexterous and safe manipulation, assistance, and locomotion in diverse environments (ground, air, water, space, in-vivo and including safety critical and hazardous environments that are corrosive, explosive, nuclear or at extremes of pressure or temperature) and in general for improved performance of robots; energy autonomy and resilience to highly limited and imperfect communication networks in on-field applications.

Two types of proposals are expected, either focusing on higher level of autonomy, expecting less reliance on human supervision, or focusing on human-machine collaboration.

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[58] Social Sciences and Humanities

[59] https://en.wikipedia.org/wiki/Intersectionality - intersectional aspects could cover gender, age, social level, education, ethnic origin, etc.

In each case, improvement in the level of robotics cognition should be demonstrated through at least three real-world scenarios (including measurements of functional performance), showing also the potential added value of such improvement in such use-cases scenarios. Scientific and technological progress should be demonstrated by qualitative and quantitative KPIs, demonstrators, benchmarking and progress monitoring. Activities are expected to achieve TRL 4-5 by the end of the project

- The first type of proposals will further develop the level of autonomy in building on the latest developments in areas such as advanced perception, smart sensors, intelligent action and interaction, reasoning and learning, increased interpretation and understanding of the complex real-world environments (possibly involving human actions), anticipation of the effect of actions, adaptation and re-planning, graceful degradation, safety and security, etc. They will, as appropriate, further develop such components, and integrate them in an advanced robotics system, consider the balance of on-board vs off-board processes and the access and utilisation of external data and cloud resources to guide tasks and missions by adding external knowledge to internal reasoning and decision-making processes.

- The second type of proposals will further develop and integrate physical human-robot interaction, verbal/non-verbal communication as well as robot-environment/object interaction, embedding, as appropiate, safety, mutual understanding perception and interpretation of human actions, interaction situated in complex real-world environments and related motivations and social structures, joint goals, shared and sliding autonomy, ethical human-centric behaviour by understanding of physiological responses and emotions, etc. to reach truly smooth human-robot collaboration. This should as well integrate advanced control developments, and further develop them as necessary to guarantee the necessary speed for the required reactivity, ensuring natural, safe and smooth interactions with humans. Appropriate use should be made of data and knowledge accumulation from internal and external sources in order to guide reasoning and decision-making and the inclusion of explainability/transparency mechanisms[60] appropriate to the use case. Such proposals should adopt a multidisciplinary approach and involve the necessary expertise in SSH[61], in particular in ethics and human-centric design to enhance trust and acceptability.

When possible proposals should build on and reuse public results from relevant previous funded actions. Proposals should make use of connections to the Digital Innovation Hub networks, particularly those in Robotics, Data and AI. Full use should be made of the common resources

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[60] Explainability mechanisms can use multiple communication modalities, verbal, non-verbal, gestural etc.
[61] Social Sciences and Humanities

available in the AI-on-Demand platform[62], Digital Industrial Platform for Robotics[63], data platforms[64] and, if necessary other relevant digital resource platforms. Communicable results from projects should be delivered to the most relevant of these platforms so as to enhance the European AI, Data and Robotics ecosystem through the sharing of results and best practice.

All proposals should also take into consideration trustworthy AI principles[65] including respect of human dignity and agency, as appropriate, given the technology focus.

This topic implements the co-programmed European Partnership on AI, Data and Robotics.

All proposals are expected to allocate tasks to cohesion activities with the PPP on AI, Data and Robotics and funded actions related to this partnership, including the CSA HORIZONCL4-2021-HUMAN-01-02. Where relevant, synergies with other PPPs are encouraged.

HORIZON-EUSPA-2022-SPACE-02-55: Large-scale Copernicus data uptake with AI and HPC

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €0.5-1M each
- Submission deadline: September 2022

Expected Outcome:

Projects are expected to contribute to the following outcomes:

- Copernicus is producing increasingly large data volumes that require specific Big Data technologies and Artificial Intelligence (AI) methods to analyse it and manage it. The adoption of Big Data and AI technologies in the space industry represents a significant opportunity to innovate, following industrial requirements to better respond to well identified user needs.
- Moreover, the data infrastructures offering archiving and distribution services for Earth Observation data, including Copernicus, are often data silos that offer today limited discoverability, querying and linking possibilities. The full exploitation of the archives and data stores require specialized Artificial Intelligence technologies, Linked Open Data

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[62] Initiated under the AI4EU project https://cordis.europa.eu/project/id/825619 and further developed in projects resulting from H2020-ICT-49-2020 call

[63] https://robmosys.eu/newsrobmosys-rosin-towards-an-eu-digital-industrial-platform-for-robotics/

[64] https://www.big-data-europe.eu/

[65] https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

paradigms and semantic archives able to scale to the full archives data volumes. Enhancing those cloud infrastructures with technological paradigms that are now typical of other data intensive domains (such as multimedia), will contribute to facilitate the development of new products and services with earth observation data at their core, and connect earth observation data to European Data Spaces.

- Copernicus data are part of the European Data Economy and its value chains. As such, this call is promoting the collaboration of ICT actors, both from industry and academia, with the earth observation/space stakeholders and Copernicus users.

Scope:

To address the expected outcomes described above, applicants are requested to respond to one of the following challenges:

- Develop new and innovative products and services designed by industrial and user requirements, having Copernicus data assets and services products at their core, and scaling up to the increased data volumes of Copernicus' archives, by solving the technological challenges related to Artificial Intelligence, AI, High Performance Computing (HPC,), Big Data processing and management, and the integration with distributed data sources from other industrial domains.
- Develop new, enabling, scalable, operational solutions and technologies to improve capabilities and performance of the Copernicus value chain and supporting infrastructure: from access and discovery of data and information (required to fully integrate Copernicus data archives, including into the wider web of data and connect to European Data Spaces, in a machine to machine modality) to integration with other data sources and analysis to delivery and applications. Proposals can address individual elements of the value chain or the value chain as a whole.

For both challenges applicants are requested to provide quantitative measures of the progress beyond the state of the art.

To ensure a balanced portfolio covering the two challenges described above, grants will be awarded to applications not only in order of ranking but at least also to one project that is the highest ranked within each area, provided that the applications attain all thresholds.

Activities are expected to start at TRL 3 and achieve TRL 5 by the end of the project.

Climate, Energy and Mobility cluster
Topics summary

Topic name	Deadline	Funding per project
HORIZON-CL5-2021-D3-02-11: Reinforcing digitalisation related know how of local energy ecosystems	5.2.22	€4M
HORIZON-CL5-2022-D3-01-12: Replicable solutions for a cross sector compliant energy ecosystem	26.4.22	€8-9M
HORIZON-CL5-2022-D3-02-01: Digital solutions for defining synergies in international renewable energy value chains	27.10.22	€3M
HORIZON-CL5-2021-D6-01-13: Safe automation and human factors in aviation – intelligent integration and assistance	19.10.21	€4-8M
HORIZON-CL5-2022-D6-01-05: Artificial Intelligence (AI): Explainable and trustworthy concepts, techniques and models for CCAM (CCAM Partnership)	12.1.22	€5-6M

Expected Outcome:

Project results are expected to contribute to all of the following expected outcomes:

- Increased autonomy of local ecosystems to participate in the decentralisation of energy systems and energy transition.
- Increase the number of participants in flexibility markets.
- Cover the gap on knowledge around digitalisation of energy services and contribute to the reskilling & upskilling of individuals and organizations.
- Facilitate the creation of a network of parties interested in joining forces for public procurement of energy related digital services.

Scope:

The digitization of the future will not be created only by leading digital technologies, but also by knowledge on and from the application areas of these technologies as well as a range of methods and strategic tools. The creation/reinforcement of local digitalisation-of- energy ecosystems as a way to support a competence cluster for digital energy concepts affecting to operators, consumers/prosumers, and authorities, which enable them being autonomous to react to local energy transition needs.

The project should create an upskilling and reskilling training program, centred on the digitalisation of energy and covering needs of local ecosystems centred on, among others, DSOs, city operators, connected active consumers (energy communities or potential new entrants) and local/regional authorities.

The training program should also contribute to capacity building of energy community members and to the support of citizens in understanding the steps to follow to create an energy community.

The project should seek to establish a cluster organization at local level for energy relevant digital technologies such as, but not only, Artificial Intelligence, Internet of Things, cybersecurity, big data, edge computing, data communications or blockchain. After identifying the needs and engaging on a local level, the project should provide extensive training in all Member States/Associated Countries and make the developed/used training material available as broadly as possible.

The project should take into account, and collaborate with, where considered necessary, the ongoing EDDIE[66] project from the Erasmus + program, relevant initiatives by Digital Innovation Hubs, EC Digital Education action plan and any other initiative geared in the same direction.

At the same time the project should investigate, and if the reaction is positive, create a network of parties interested in joining forces for public procurement of digital services. One example could be tools for cities to participate in energy flexibility markets that are interoperable, where already present, with their Smart City Platforms)

The selected projects are expected to contribute to relevant BRIDGE[67] activities.

This topic will benefit from the effective contribution of SSH disciplines and the involvement of SSH experts, institutions as well as the inclusion of relevant SSH expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities. The Commission will make sure that projects benefit from SSH expertise through the cooperation in Bridge.

HORIZON-CL5-2022-D3-01-12: Replicable solutions for a cross sector compliant energy ecosystem

Essentials in a nutshell:

- Circa 4 projects are expected to be funded, for €8M each.
- Submission deadline: 21/09/21.

Expected Outcome:

Project results are expected to contribute to most of the following expected outcomes:

- A catalogue of services and flexibility potential of appliances tailor-made for specific consumer groups, as well as the accompanying IT-tools that can help them providing flexibility services to the energy market and system.
- Increase participation of energy consumers in demand side flexibility markets by reducing entry barriers and transaction cost, in particular in relation to data exchange and market access.
- Provide viable interoperable solutions and products, available to all levels of the grid including within the home, which makes it simple to increase flexibility in energy

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[66] http://www.eddie-erasmus.eu/
[67] https://www.h2020-bridge.eu/

consumption and have a positive impact in balancing demand/response with an increasing share of renewable energy sources.

- Create a vibrant cross-sector ecosystem, successfully mobilising demand-response and demonstrating opportunities for new services provided by SMEs and start-ups.
- Create sustainable marketplaces based on a comprehensive catalogue of energy smart appliances (home appliances including EV charging and distributed energy storage), services and hardware/software solutions compliant with a set of standards for Minimum Interoperability.
- Demonstrate the potential for a sustainable up-take (coordinated across all projects from the call) based on components and solutions piloted in real life.

Scope:

Promote the adoption and usage of connected interoperable energy smart home appliances (including the EV charging and home storage) and solutions in order to accelerate the deployment of demand-side flexibility services, reduce the entry barrier and facilitate replication.

- Identify a set of open standards for Minimum Interoperability based on the results of multiple research and innovation projects and existing technological developments as well as already available open standards and/or open source solutions to enable energy smart appliances and solutions to participate in demand side flexibility.
- Provide new business models supported by innovative interoperable solutions enabled by connecting systems from different sectors.
- Test interoperable services/solutions based on a reference architecture and minimum interoperability mechanisms that can enable flexibility.
- The solutions initially developed in a pilot in one country will have to be tested, in real life, in at least two other countries, with different energy constraints, by different entities. The overall target is replication in as many Member States/Associated Countries as possible.
- Create and populate a commonly agreed catalogue of energy smart home appliances (including EV charging and storage), services and hardware/software solutions compliant to a set of standards for Minimum Interoperability.
- The call is open to all stakeholders. For instance, utilities, ESCO/aggregators, appliances manufacturers, energy cooperatives, retailers owning buildings (heating/cooling) in many cities, office building that in their parkings offer eV chargers, water treatment plants, public buildings, schools, ICT companies, system integrators, Data Centre operators, EV manufacturers, storage providers, industry and other relevant stakeholders with a role in the energy flexibility market.
- The projects should support the proliferation of innovative energy and energy services markets building on interoperable solutions that can be tailored easily to the type or need of users. Therefore the projects should take into account the social and behavioural

dimensions of consumer's participation and to get the acceptance of different energy technologies.

- The solutions are expected to adapt digital technologies to the specificities and requirements of the energy system (Artificial Intelligence, Big Data, 5G, cloud/edge computing, Internet of Things ...).
- While complying with cybersecurity requirements privacy issues are to be specifically considered. They have to be built on open architectures and commonly agreed standards derived from these technologies (such as SAREF) and relevant European and Global ICT and Energy Standards Development Organisation and associations
- The selected projects will cooperate among themselves and with other relevant projects through regular common workshops, exchange of non-confidential reports, etc.

HORIZON-CL5-2022-D3-02-01: Digital solutions for defining synergies in international renewable energy value chains

Essentials in a nutshell:

- Circa 3 projects are expected to be funded, for €3M each.
- Submission deadline: 27.10.22

Expected Outcome:

Project results are expected to contribute to some of the following expected outcomes:

- Advance the European and global scientific basis, European leadership and global role in the area of renewable energy and renewable fuels and related energy value chains while creating evidence for policy making by developing novel digital solutions.
- Provide digital breakthrough solutions for promoting the increase of the global renewable energy share.
- Reinforce the European scientific basis through international collaboration while increasing the potential to export European renewable energy technologies and ensuring political priorities in the context of sustainable global energy value chains.
- Improve reliability of system components, advanced and automated functions for data analysis, diagnosis and fault detection, forecasting and model-predictive control frameworks, ancillary services for the stability of the network; maintenance planning and/or reporting.

Scope:

Development of novel real time and open data monitoring and/or simulation solutions (e.g. including digital twins) for sustainable energy production and consumption, predictive modelling

and artificial intelligence for the analysis of international renewable energy value chains and for internationally aligned decision-making in cooperation with international partners from Mission Innovation Countries. To ensure trustworthiness, wide adoption by user communities and support EU policy-makers, actions should promote the highest standards of transparency and openness, going well beyond documentation and extending to aspects such as assumptions, models and data related to renewable energy and fuels.

HORIZON-CL5-2021-D6-01-13: Safe automation and human factors in aviation – intelligent integration and assistance

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €4-8M each.
- Submission deadline: 19/10/21.

Expected Outcome:

Project results are expected to contribute to all of the following expected outcomes:

- Improved monitoring of human performance, system performance and external hazards, in order to pave the way to more automation in aviation while meeting Flightpath2050 safety goals.
- Avoiding startle response or "automation surprise", enabling intelligent assistance to all operators on the air and on the ground in all safety-critical situations and allowing fallback response in case of severe system perturbations - including pilot incapacitation, cyber-attacks and/or broader operational system-wide failures.
- New crew and team configurations, including human-machine teaming, automation supervisory roles and distributed human crew (both airborne and on the ground) to ensure safety and optimise performance without leading to complacency or to loss of critical skills.
- Better prepared workforce and training, with smarter selection, qualification and training tools and methods to maintain high standards of safety and resilience, including advanced simulation for complex safety-critical events.
- Increased organisational and regulatory preparedness, safety culture and societal acceptance in the advent of more automation in aviation, from earlier integration of human factors and automation into design processes and safety case methods up to ensuring an appropriate level of human factors and automation competence in key organisations, including regulators.

Scope:

Activities should address a renewed safety focus on the teaming between the human and automation, given the steady increase in automation in aviation operations at large (e.g. in cockpit, ATC, maintenance, etc.), including for new airborne services and vehicles such as drones. When automation is unable to cope, control should be handed back safely to the human.

Prepare the next step-change in automation, artificial intelligence (AI), in two steps. Firstly, in the medium term with the role of AI as 'Digital Assistant', part of the team, earning the trust of the human operators and the flying public. Secondly, in the long term, with the potential of AI to take over operations. For the transition to digital assistant and ultimately to AI-run operations, develop a novel approach to Human Factors and to safety (and security) assurance methods and processes.

System transition issues should be addressed, to avoid an initial spate of 'automation-assisted accidents', as it happened at the last step change in the level of automation in aviation ('glass cockpits'), which nevertheless resulted in significantly improved safety.

Activities should consider the increasing complexity in aviation e.g. traffic growth expected back in the mid/long-term, more 'new entrants' as drones, more extreme weather events, more environmental constraints leading to more complex systems and operations. In such an evolving aviation environment it is needed to better understand and anticipate why incidents happen – the triggering events/hazards, the cognitive failures and the challenges at the humanmachine interface – in order to learn the right lessons and then share them both internally and externally. This includes the impact of physical and mental wellbeing on human performance and safety, both in a positive sense (e.g. motivation, positive safety culture) and in a negative sense (e.g. fatigue, constraints during/after pandemic times, fitness for duty, skill loss, and complacency).

More focus is needed then on Human Digital Interface design and on integrating AI into human crews and teams, as a smart assistant to explain, accompany and support operators, in particular at safety-critical situations and to recover from emergencies. More adaptive and trustworthy human-machine systems and more intuitive interfaces should be developed.

Developments should be applied to realistic operational and regulatory contexts while devising how to maintain safety culture and societal acceptance along with organisational and regulatory preparedness. Particular attention should be paid to possible differences such as age, gender and ethnography. Social innovation is recommended when the solution is at the socio-technical interface and requires social change, new social practices, social ownership or market uptake.

This topic requires the effective contribution of Social Sciences and Humanities (SSH) disciplines and the involvement of SSH experts, institutions, as well as the inclusion of relevant SSH

expertise, in order to produce meaningful and significant effects enhancing the societal impact of the related research activities.

Activities should go beyond the state of the art and previous R&I activities, at least at EU level[68]. Activities should ensure no overlap but complementarity for integration with any other aviation activities, such as SESAR / Transforming the European ATM System partnership. The proposals may include the explicit commitment from the European Aviation Safety Agency (EASA) to assist or to participate in the actions.[69]

In order to achieve the expected outcomes with increased resources and impact, international cooperation can be foreseen with third countries with relevant capacities in this domain, while ensuring that the respect of European IPR, interests and values is strictly guaranteed.

Synergies with other transport modes and safety/security critical sectors adopting more automation is welcomed, in particular on risk assessment and pre-normative research to ensure fit-for-purpose rulemaking and management systems and a high level of cyber-attack protection.

Synergies with other topics in Horizon Europe can be exploited such as in Cluster 4 e.g. HORIZON-CL4-2021-DIGITAL-EMERGING-01-02 (Software for low-power operation at the edge), HORIZON-CL4-2021-DIGITAL-EMERGING-01-11 (Pushing the limit of robotics cognition), in Cluster 3 e.g. HORIZON-CL3-2021-INFRA-01-01 (European infrastructures and their autonomy safeguarded against systemic risks), as well as with other EU programmes such as Connecting Europe Facility (CEF), NextGenerationEU and Digital Europe.

HORIZON-CL5-2022-D6-01-05: Artificial Intelligence (AI): Explainable and trustworthy concepts, techniques and models for CCAM (CCAM Partnership)

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €85-6M each.
- Submission deadline: 12.1.22.

Expected Outcome:

Project results are expected to contribute to all of the following expected outcomes:

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[68] Examples of aviation safety research projects available on:
- Projects For Policy (P4P) on Aviation Safety https://publications.europa.eu/en/publication-detail/-/publication/b4690ade-3169-11e8-b5fe-01aa75ed71a1/language-en/format-PDF/source-75248795
- Coordination-support action OPTICS2 https://www.optics-project.eu/narratives/
[69] https://www.easa.europa.eu/domains/safety-management/research

- Concepts, techniques and models based on Artificial Intelligence (AI) used for situational awareness, prediction, decision making and triggering of actions for time critical and safety relevant CCAM applications as well as for cyber threat detection and mitigation.
- A clear understanding of the capabilities, limitations and potential conflicts of AI based systems for CCAM.
- Increased user acceptance from an early stage, based on explainable, trustworthy and human-centric AI. Interactions with vehicles using AI should be understandable, humanlike and reflect human psychological capabilities, and free of gender, ethnic or other biases.
- Accelerated AI development and training for CCAM enabled by a relevant set of real and synthetic traffic events and scenarios.
- AI based CCAM solutions will evolve from reactive and/or adaptive system support into predictive system state awareness (including driver state and user diversity), decisionmaking and actuation, enhancing road safety especially in near-critical situations.

Scope:

The deterministic understanding and consequential design of assistance systems are mostly reactive or to some extent adaptive. In the transition from driver assistance systems towards fully automated systems, a critical aspect is the decision making (i.e. planning and acting), based on robust and reliable detection and perception. AI has a huge potential to advance this process.

Specifically, in more complex and dense traffic environments, highly automated driving functions will benefit from the system state prediction enabled by AI. Yet, the current state of technology using AI for CCAM has limitations regarding human-like actions, more specifically the intuitive, split-second (predictive) assessments and 'reflex decision making'. As such, any AI requires good integration into the overall system with close interaction and compatibility with the active safety systems (e.g. automated emergency braking).

For the development process, training is essential for the performance of unbiased AI. It requires sufficient traffic and event data under varying conditions from all over Europe, avoiding limited data sets. The current, mainly deterministic approaches for validation in automotive development will not be sufficient for future training and validation of AI-based or AI-supported functions, which will also need to be able to deal with complex issues as (un)intended miscommunication.

Proposed R&I actions therefore are expected to address all the following aspects

- Support the development and integration of AI in CCAM with explainable, trustworthy and human-centric and unbiased concepts, techniques and models; this can be on vehicle

level and on transport system level, where tactical and strategic links to traffic management and traffic conditions need to be established.

- Address the knowledge gap on AI training and validation approaches as well as efficient and ethical approaches for data handling of increasing amounts of data.
- Build upon existing and generated data for training and verification of AI supporting situational awareness in CCAM in more complex traffic scenarios (e.g. digital twins).

Specific automotive requirements on functional safety and security need to be considered in the development process of an automotive-grade AI ensuring consistency with existing validation procedures.

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

In order to achieve the expected outcomes, international cooperation is advised, in particular with projects or partners from the US, Japan, Canada, South Korea, Singapore, Australia.

This topic implements the co-programmed European Partnership on 'Connected, Cooperative and Automated Mobility' (CCAM).

Food, Bioeconomy, Natural Resources, Agriculture and Environment cluster

Topics summary

Topic name	Deadline	Funding per project
HORIZON-CL6-2021-FARM2FORK-01-06: Vaccines and diagnostics for priority animal diseases	6.10.21	€6M
HORIZON-CL6-2021-FARM2FORK-01-11: Digital transition supporting inspection and control for sustainable fisheries	15.2.22	€4M
HORIZON-CL6-2022-FARM2FORK-01-04: Innovative solutions to prevent adulteration of food bearing quality labels: focus on organic food and geographical indications	27.10.22	€3M
HORIZON-CL6-2022-FARM2FORK-01-11: Effective systems for authenticity and traceability in the food system	15.2.22	€10M
HORIZON-CL6-2022-CIRCBIO-02-05-two-stage: Life sciences and their convergence with digital technologies for prospecting, understanding and sustainably using biological resources	First stage: 15.2.22 Second stage: 1.9.22	€6-8M
HORIZON-CL6-2021-GOVERNANCE-01-17: Common European Green Deal data space to provide more accessible and exploitable environmental observation data in support of the European Green Deal priority actions	6.10.21	€3-5M
HORIZON-CL6-2021-FARM2FORK-01-11: Digital transition supporting inspection and control for sustainable fisheries	6.10.21	€5M
HORIZON-CL6-2022-FARM2FORK-01-04: Innovative solutions to prevent adulteration of food bearing quality labels: focus on organic food and geographical indications	15.2.22	€4M
HORIZON-CL6-2022-COMMUNITIES-01-05: Assessing the socio-politics of naturebased solutions for more inclusive and resilient communities	15.2.22	€6M

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €6M each.
- Submission deadline: 6.10.21.

Expected Outcome:

In line with the farm to fork strategy, for a transition to fair, healthy and resilient livestock production systems, including the reduction of anti-microbial usage, a successful proposal will support research and innovation (R&I) to help policy makers and economic operators reduce the burden of infectious animal diseases, thus contributing to a sustainable livestock industry and public health (food safety, zoonoses, anti-microbial resistance).

The project results are expected to contribute to all of the following outcomes:

- Enhanced capacity to prevent or control relevant priority diseases, through the provision of innovative tools and products to policymakers, the veterinary profession and business operators; and
- Increased knowledge of virulence factors, mechanisms of infection and protection and identification of protective antigens needed for effective vaccine development.

Scope:

Vaccines and diagnostics are essential components of the toolbox for preventing and controlling infectious animal diseases and limiting their impact, including the potential reduction of anti-microbial usage. The development or improvement of vaccines for regulated diseases may not be attractive for the pharmaceutical industry and public support may be needed because of market failure. It is important that the toolbox includes early, fast and reliable diagnostics, which may go hand in hand with vaccination (e.g. DIVA tests). New developments in science and technology (e.g. genomics, artificial intelligence) enable a fresh approach to vaccine and diagnostic development.

Proposals should address, for terrestrial livestock and relevant wildlife, improvements in vaccine technologies (e.g. adjuvants, stability and administration), products (e.g. new/improved vaccines, vaccines addressing multiple pathogens), underpinning knowledge (virulence factors, infection and protection mechanisms, protective antigens necessary for effective vaccine development) and related diagnostics, and look into the feasibility of vaccine production based on existing or novel vaccine platforms. Use of artificial intelligence to decipher target antigens is encouraged.

Diagnostics for infectious diseases in terrestrial livestock and related domains is recommended, for instance to set animal-specific clinical breakpoints for susceptibility of key veterinary pathogens for which disease-specific breakpoints are unavailable and generic breakpoints based on antimicrobial concentrations in serum are not relevant. Point-of-care and multi-pathogen diagnostic tools are particularly helpful for strengthening surveillance and capacity to respond to threats.

The choice of infectious agents / diseases should take into account their importance for EU policy and regulation, e.g. by virtue of being responsible for epizootic diseases such as African swine fever, African horse sickness, or being priority zoonotic diseases, contributing to anti-microbial resistance, or having serious socio-economic impacts more generally. Proposals may use priorities identified under OIE[70], in EU animal health law, or by the

SCAR Collaborative Working Group on Animal Health and Welfare[71], Discontools[72], or the STAR-IDAZ International Research Consortium.[73]

Participation of industry is highly recommended.

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

International research cooperation with institutions outside the EU is welcome insofar as it brings clear added knowledge, value and expertise to the project and maximises the impact. Proposed research should take into account other EU funded projects, including those funded under ICRAD ERA-NET.[74]

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[70] https://www.oie.int/fileadmin/SST/adhocreports/Diseases%20for%20which%20Vaccines%20c
https://www.oie.int/fileadmin/Home/eng/Internationa_Standard_Setting/docs/pdf/SCAD/A_SCAD_Sep
[71] https://www.scar-cwg-ahw.org/wp-content/uploads/2018/04/Final-Report-CWG-AHW-CASA_updated-EU-AH-SRA.pdf
[72] http://www.discontools.eu/
[73] http://www.star-idaz.net/
[74] https://www.icrad.eu/

HORIZON-CL6-2021-FARM2FORK-01-11: Digital transition supporting inspection and control for sustainable fisheries

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €5M each.
- Submission deadline: 6.10.21.

Expected Outcome:

In line with the European Green Deal objectives, Common Fisheries Policy, the farm to fork strategy for a fair healthy and environmentally friendly food system, and the blue growth strategy, the successful proposal will support better fisheries management through data and technological development. Project results are expected to contribute to some or all of the following expected outcomes:

- Advancing the digital transition for fisheries inspection and control and deliver data for fisheries science, management and monitoring in a cost-efficient way to fully achieve the objectives of the Common Fisheries Policy (CFP).
- Delivering innovative technological solutions such as machine learning and artificial intelligence and advance sensing technologies to support biologically complex data analysis
- Devise new monitoring and control strategies to stop illegal, unreported and unregulated fishing (IUU) and promote sustainable fisheries in the EU and globally.
- Create a new generation of jobs in the EU requiring digital and high-tech know-how applied to fisheries.
- Improve the professional skills and competences of those working and being trained to work within the blue economy.

Scope:

The CFP aims to ensure that fisheries are environmentally, economically and socially sustainable and provide a source of healthy food for EU citizens. The CFP adopts a cautious approach, which recognises the impact of human activity on all components of the ecosystem. It seeks to make fishing fleets more selective in what they catch, to phase out the practice of discarding unwanted fish and to fight IUU vigorously. These illegal practices deplete fish stocks, destroy marine habitats, distort competition, put honest fishers at an unjust disadvantage and weaken coastal communities, particularly in developing countries. The EU is working to close the loopholes that allow illegal operators to profit from their activities. To be successful, the EU needs to have in place a technologically advanced and effective fisheries control system. Fighting IUU requires

global cooperation, namely through regional fisheries organisations, to foster synergies by adopting innovative control technologies and data standards by fishing, coastal, port and consumer states.

Despite the advances attained since its inception, important challenges remain to ensure that the CFP aims are fully met. The availability and quality of fisheries data should be improved and more needs to be done to ensure that these data are shared systematically between all relevant entities, including fisheries scientists. In the EU, current control measures are only partially effective at ensuring the enforcement of the landing obligation, and of fully documented fisheries more generally. Accurate recording and accountability of by-catches of sensitive species, such as birds and mammals, and of marine biological resources are essential for an ecosystem approach to fisheries and for a sound stock assessment, which are in turn the foundation of responsible and sustainable fisheries management. The control and monitoring of vessels operating outside EU waters (long-distance fleet) as well as the small-scale fleet and recreational fisheries need particular attention.

Moreover, in order to ensure that EU fish imports come from sustainable fisheries and to promote the eradication of IUU worldwide it is necessary to cooperate with third-countries and international organisations to strengthen and promote the use of similar cost-efficient control technologies and data standards. The digital revolution has to contribute to ensure accurate catch registration data, including from weighing at landing, the verification of measures on fishing capacity applicable to vessels engine power, better traceability of fisheries products and improved catch certification schemes.

Digitisation and advanced tools applied to fisheries, such as Remote Electronic Monitoring Systems (REMs), artificial intelligence, machine learning tools, sensor data and highresolution satellite imagery, have enormous potential to optimise fishing operations and enhance our ability to collect and analyse data, as well as improve monitoring and control capabilities and ultimately support a sustainable management of marine biological resources.

Research and innovation under this topic should review existing and develop new technological solutions to improve: (i) detection of illegal discards; (ii) checks on weighing, weighing systems and accurate catch registration; (iii) data management and reporting and third-party reporting based on remote electronic monitoring systems on vessels; (iv) risk management applied to fisheries; (v) monitoring and control of small-scale, recreational and long-distance fleet, (vi) electronic marking of fishing gear, (vii) identifying IUU activities as well as fisheries products stemming from those activities, (viii) promoting data standards and protection, remote access to data and automatic data exchange protocols, and (ix) innovative tools to assess compliance with technical requirements and measures applicable to fishing vessels, such as continuous engine power monitoring.

Research under this topic should be cross-disciplinary bringing together marine scientists, maritime (including fisheries) surveillance and control authorities, IT specialists and governance experts.

Where relevant, proposals may seek synergies and capitalise on the results of projects funded under Horizon 2020, Horizon Europe, European Maritime and Fisheries Fund, its continuation European Maritime, Fisheries and Aquaculture Fund, and other funding streams.

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

HORIZON-CL6-2022-FARM2FORK-01-04: Innovative solutions to prevent adulteration of food bearing quality labels: focus on organic food and geographical indications

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €4M each.
- Submission deadline: 15.2.22.

Expected Outcome:

The farm to fork strategy aims to accelerate the transition to sustainable farming and food systems by, inter alia, promoting the growth of organic farming with a view to achieve the target of at least 25% of the EU's agricultural land under organic farming by 2030. Moreover, the strategy envisages the strengthening of geographical indications (GIs), by including specific sustainability criteria, where appropriate. One of the strategy's main priorities is to combat food fraud along the food supply chain. The successful proposals should therefore contribute to preventing food fraud of products with quality labels, in particular organic and GIs. In this way, they should facilitate progress towards the strategy's challenging target for organic farming and strengthen the GIs scheme.

Projects results are expected to contribute to all of the following expected outcomes:

- a wider use of new and improved tools and field-deployable methods and approaches for rapid and cost-effective verification of claims related to food products of plant and animal origin with quality labels, in particular organic and GIs;
- unlocked potential of new technologies and other innovative approaches (e.g., business models) fit for farmers and food businesses (especially small-scale farmers and small and medium-sized enterprise (SMEs)) as well as policymakers, which cost-effectively enable

traceability and transparency along the supply chains of quality labelled food, in particular those with organic and GIs labels;

- improved functioning and effectiveness of the control systems in Member States and Associated Counties and the EU's legislative framework for organic and GI food products;
- increased data availability, interoperability and use, and improved analytical capacity for enhanced traceability and transparency along the supply chains of quality labelled food, in particular organic and GIs;
- well-informed decision-making by farmers, food businesses and policymakers to improve climate, environmental, economic and social sustainability along the supply chains of quality labelled food, in particular organic and GIs.

Scope:

Quality labelled food products, such as organic and GIs, are generally more expensive than their counterparts. Therefore, foods with such quality labels are particularly prone to fraud. Illegal practices can considerably harm the quality schemes, as they can undermine consumer confidence, thus damaging the farmers and food businesses who respect the rules. The main challenge is that it is difficult for consumers and operators across supply chains to visually distinguish genuine from false organic or GI products. Traditional methods of determining food quality are time consuming and usually require special laboratory analyses, which are often costly and may not be sufficient to guarantee a product's authenticity and traceability. In addition, as organic and GI food supply chains become more complex, the need to ensure product traceability and transparency along the entire chain increases. Existing traceability and control systems help track products throughout the food supply chain and improve transparency. However, the organic and GI sectors rapidly change due to, for example, widespread use of e-commerce, and given the expected growth of these sectors, the risk of fraud may increase. Therefore, it is important to continuously innovate and upgrade the approaches to prevent fraudulent practices. Diverse new technologies and other innovative solutions (e.g., business models; participatory certification; local, short or mid-tier supply chains; etc.), are emerging to improve the authentication and traceability of quality labelled food products, in particular those with organic and GI labels, as well as to increase transparency of supply chains, thereby contributing to combating fraud. These innovative solutions need to be developed/improved, tested, demonstrated and deployed.

Proposals should investigate the current fraud practices affecting quality labelled food products, in particular organic and GI, and analyse the root causes/drivers of these practices and obstacles and ways to eradicate them. Based on these insights and building on the stateof-the-art in research and innovation, proposals should develop/improve, test, demonstrate and pilot promising innovative low-cost methods, tools and approaches to authenticate and/or trace quality labelled food products, especially organic and GIs, as well as to improve

transparency of their supply chains from farm to fork. They should explore the potential of various technological and non-technological innovative solutions (e.g., digital (such as photonics, artificial intelligence (AI), blockchain, internet of things (IoT), machine learning, etc.), new business models (in particular involving and suitable for small-scale farmers and SMEs), suitable reference materials, rapid and field-deployable, non-destructive testing methods, technologies to improve cybersecurity, etc.), and their combinations. The heterogeneity of products and sectors, as well as the diversity of supply chains and contexts should be taken into account. Proposals should also investigate the barriers and incentives to scaling up the use of the innovative solutions as well as assess the positive and negative impacts on the different operations and actors in the organic and GI food value chains, particular attention should be paid to small-scale farmers, SMEs and consumers, as well as the control systems used in Member States and Associated Countries. Proposals should also develop a system to increase availability of and access to relevant data, promote data harmonisation and improve the ways in which data are stored. In addition, they should explore ways to advance the analysis, use, interoperability and security of data to enhance fair transparency and support better decision-making, to improve sustainability along organic and GI food supply chains.

The innovative solutions should be widely disseminated and recommendations for relevant actors in the public sector and business should be provided. Close involvement and consultation with project advisory board members is recommended. Projects should use the 'multi-actor approach', ensuring adequate involvement of all relevant actors, including input suppliers, farmers and SMEs. Proposals may build on existing research infrastructures, where relevant. Proposals are encouraged to build on past and ongoing EU-funded research and innovation projects, and are strongly encouraged to cluster with upcoming projects under the HORIZON-CL6-2021-FARM2FORK-01-10, HORIZON-CL6-2022-FARM2FORK-01-11 and HORIZON-CL6-2021-FARM2FORK-01-17 topics. They are also encouraged to cooperate with actors working on related initiatives, including the European Commission's Joint Research Centre (JRC) Knowledge Centre for Food Fraud and Quality, which provides expertise in food science, authenticity and quality of food supplied in the EU. The possible participation/contribution of the JRC in the project would consist of ensuring that the project deliverables are compatible with and/or improve existing databases and tools used at the European Commission and fostering open access to project results via dissemination through the European Commission Knowledge Centre for Food Fraud and Quality.

This topic should involve the effective contribution of SSH disciplines. For this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €8M.
- Submission deadline: 15.2.22.

Expected Outcome:

In line with the European Green Deal priorities and the farm to fork strategy for a fair, healthy and environmentally friendly food system, the successful proposal will support R&I in improving traceability and combating food fraud along the food supply chain. It will contribute to the transformation of food systems to deliver co-benefits for climate (mitigation and adaptation), environmental sustainability and circularity, dietary shifts, sustainable healthy nutrition and safe food, food poverty reduction and empowerment of communities, and thriving businesses.

Project results are expected to contribute to all of the following outcomes:

- A robust knowledge base of the underlying reasons for/drivers of food fraud (e.g. economic and social) and the extent of food fraud.
- Innovative strategies and solutions (tools and devices) to prevent fraudulent practices by improving traceability and safeguarding authenticity, and fostering solutions for fraud prevention.
- Improved assistance to control bodies and authorities in fraud prevention.
- Improved transparency through digital solutions (such as IoT, artificial intelligence, blockchain and distributed ledger technologies) that meet consumer demand for food transparency, with a focus on demonstrating authenticity of food as a way to reduce food fraud and boost consumer confidence in food origin and quality.
- Contribution to further development of policies for food authentication and traceability and for fighting food fraud/food crime.
- Support official control by providing guidance on detection and mitigation of fraudulent practices.

Scope:

To contribute to the goals of the farm to fork strategy, the EU will scale up its fight against food fraud to create a level playing field for operators and strengthen the powers of control and enforcement authorities. The new EU Official Controls Regulation (Regulation (EU) 2017/625) includes key provisions in relation to food fraud. Recently, the issue of food fraud has been thrust

into the spotlight and is of increasing concern to society and to the food industry. It can have very different impacts on consumers, ranging from direct health threats (e.g. consumption of toxic adulterants and contaminants) to violation of consumer rights (e.g. mislabelling). With the complexity of the global market and the addition of e-commerce, the safety risks of food fraud are likely to increase. Therefore, there is a constant need for sensitive and accurate authentication methods and innovative traceability methods to prevent food fraud and help the industry and official control authorities. Maintaining the integrity of European foods is vital to protect both consumers and the legitimate producers, industry and retail, and foster consumer confidence in the authenticity of all food products.

Successful proposals are expected to address both areas (area A and area B):

Area A:

- Take stock and determine the current state-of-the-art, identify gaps, and suggest short-, medium- and long-term strategies for closing gaps in research addressing various aspects of fraud such as societal and economic drivers, fraud opportunities, mitigation and prevention measures.
- Quantify the economic dimension of the food fraud problem and understand the behaviour of food criminals perpetrating food fraud.
- Carry out translational research on fraud detection methods to provide the required evidence base for harmonisation and standardisation of methods and harmonisation of strategies for regulatory use.
- Develop and validate rapid food fraud detection tools and real-time in-situ/on-line analytical methods for testing authenticity and quality.
- Develop and implement new food fraud detection models (based on data, by applying artificial intelligence techniques) and tracing methods through the use of new and emerging technologies, such as blockchain and smart labelling tools.
- Build common platforms and tools for sharing information among stakeholders.

Area B:

- Support the development of an early warning system (EWS) for detection and possible further prevention of fraudulent practices and an efficient use of artificial intelligence, taking into consideration the data protection rules in place.
- Evaluate the utility of different food-authenticity-related databases existing in Member States and the EU institutions, and create a central database/data portal for further use of these data by authorised users to improve fraud detection and enforcement actions by the competent authorities.

- Develop tools that increase consumers' confidence in the authenticity and quality of the food supply, in line with the relevant legal frameworks.
- Investigate food chain stakeholders' attitudes towards adulterated food to understand better their motivation to commit fraud and trade-in inferior quality goods.

The required multi-actor approach (see the eligibility conditions) must be implemented by involving a wide diversity of food system actors and conducting inter-disciplinary research. Proposals should bring together major stakeholders and scientific expertise to protect consumers and industry from food fraud.

Projects relevant to this topic should support policymaking and implementation relevant to fighting food fraud.

Proposals should explain how they will contribute to achieving the objectives of the farm to fork strategy and deliver co-benefits to the four Food 2030 priorities.

Proposals should involve a wide diversity of actors and implement an inter- and transdisciplinary approach. They are encouraged to build on past and ongoing EU-funded research, and are strongly encouraged to cluster with upcoming projects under the HORIZON-CL6- 2022-FARM2FORK-01-04 topic: Innovative solutions to prevent adulteration of food bearing quality labels: focus on organic food and geographical indications. They are also strongly encouraged to work with existing research infrastructure and collaborate with relevant initiatives, including specifically the European Commission's Joint Research Centre (JRC) Knowledge Centre for Food Fraud and Quality, which provides expertise in food science, authenticity and quality of food supplied in the EU. The possible participation of the JRC in the project will ensure that the project deliverables are compatible with and/or improve existing databases and tools used at the European Commission and foster open access to project results via dissemination through the European Commission Knowledge Centre for Food Fraud and Quality, particularly to the competent authorities of the EU Member States.
Proposals should set out a clear plan on how they will work with other projects selected under this and any other relevant topic, by participating in joint activities and running common communication and dissemination activities. Applicants should plan the necessary budget to cover these activities.

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

This topic should involve the effective contribution of SSH disciplines.

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €6-8M each.
- Submission deadline: first stage: 15.2.22, second stage: 1.9.22

Expected Outcome:

In line with the European Green Deal and other European initiatives such as the circular economy action plan, the industrial strategy, the bioeconomy strategy and the biodiversity strategy, the successful proposal should support the uptake of bio-based innovation, to improve European industrial 259 sustainability, competitiveness and resource independence. They should develop innovative bio-based products using the full benefits of artificial intelligence and other digital technology innovation. They should engage all stakeholders and improve their knowledge and understanding of science, notably biotechnology-based value chains, and improve benefits for consumers.

Project results tshould contribute to all of the following outcomes:

- Use the full potential of artificial intelligence applications for prospecting, understanding and sustainably using biological resources within safe planetary boundaries.
- Digital tools, sensors and methods for improved efficiency, climate change adaptation and sustainability of industrial processes in the bio-based sectors considering the needs of stakeholders are integrated in innovative engineering solutions.
- Enhanced monitoring, reporting and management of natural resources using artificial intelligence and other digital technology applications.

Scope:

Engineering biology applications have grown beyond chemical production to include the generation of biosensor organisms for the lab, animal, and field, modification of agricultural organisms for nutrition and pest/environmental resilience, production of organisms for bioremediation, and live cell and gene/viral therapies. The rapid expansion of the field has resulted in new tools and new approaches. However, we are still challenged by the need for novel and more robust and interoperable computational tools and models for engineering biology. For example, improved models of synthetic systems (synthetic biology) and of their interaction with their host organisms could help enable more successful engineering.

This information infrastructure for biological design is at an early stage compared to engineering disciplines such as mechanical and electrical engineering, as the biomanufacturing field has emerged only recently. A critical bottleneck is a lack of established "design rules," core aspects of biological and biomolecular function that apply to diverse systems and applications. Furthermore, technologies for the utilization, manufacture, and deployment of innovative bio-based systems are still under development. These roadblocks have hampered the development of standard computational frameworks to represent, process and store information on biological components, predict system behaviour, and diagnose failures. Therefore, widespread automation in the bio-based sectors remains out of reach.

A mature computational infrastructure for biodesign requires powerful access to information on biological parts and systems, their environments, their manufacturing processes, and their operations in and beyond the laboratory in which they are created. This in turn requires findable, accessible, interoperable, and reusable data that enable effective aggregation information on bio-based systems, their environments, and their processes of manufacture, and the establishment of standard models of data processing and analysis, including bioinformatics, biosensors, bioindicators, '-omics' technologies that allow open-development and scalable execution in the bio-based sectors.

The topic aims to prevent pollution and sustainably manage and use natural resources within safe planetary boundaries, including in the deployment of the bioeconomy and the bio-based sectors. The topic focuses on bioinformatics, "cheminformatics" and artificial intelligence as approaches and tools to transform available information into biologically or biotechnologically applicable knowledge. It also aims to efficiently integrate digital technologies into bio-based operations to optimise value chains from a technical, economic, social and environmental point of view.

Proposals should:

a. Enable prospecting, understanding and sustainable use of biological resources based on their convergence with digital technologies that lead to optimised and more efficient biobased operations.

b. Identify and characterise advanced technologies, including artificial intelligence, and their benefits for the utilisation, manufacture, and deployment of innovative bio-based systems.

c. Develop integrated biological designs and data models for improved prospecting, understanding and deployment of higher efficiency and sustainability of biological resources and industrial bio-based operations (e.g. bioinformatics, biosensors, bioindicators, data analysis, '-omics' technologies).

d. Improve the economic and environmental sustainability of bio-based operations.

e. Focus on the integration of -omics and machine learning techniques such as active learning for the design-build-test-learn (DBTL) cycle.

f. Develop improved models and model standards of synthetic systems (synthetic biology) and of their interaction with their host organisms to facilitate more successful engineering and broader application in the bio-based sectors.

g. Establish bio computer-aided design (BioCAD) tools and design-of-experiment (DoE) approaches.

h. Reinforce and maintain scientific infrastructures to integrate existing biodiversity information (species, habitats and environmental processes).

i. Consider contributing data and results to the European Commission's Knowledge Centre for Bioeconomy hosted by the JRC.

For this topic, it is not mandatory to integrate the gender dimension (sex and gender analysis) into research and innovation.

HORIZON-CL6-2021-GOVERNANCE-01-17: Common European Green Deal data space to provide more accessible and exploitable environmental observation data in support of the European Green Deal priority actions

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €3-5M each.
- Submission deadline: 6.10.21.

Expected Outcome:

A successful proposal will contribute to unleashing the potential of environmental and climate data through dedicated European data spaces in line with the objectives of the European Green Deal and the European strategy for data, by further deploying digital and data technologies as key enablers and strengthening EU and international science-policy interfaces as well as contributing to the Global Earth Observation System of Systems (GEOSS).

Proposals are expected to contribute to all of the following outcomes:

- Available FAIR data, information and knowledge in support of the European Green Deal priority actions on climate change, circular economy, zero pollution, biodiversity, deforestation and compliance assurance;
- Consolidated arrangements for European Green Deal data access, sharing and interoperability, in line with the FAIR principles for data, to facilitate the combination of data for policy analysis fostering as such innovative data analytic solutions;
- Concrete solutions and tools using data analytics and machine learning techniques to support to the European Green Deal priority actions;
- Increased convergence of the use of high performance computing, cloud, edge, computing, data analytics and artificial intelligence resources for Earth system modelling.

Scope:

Successful proposals are expected to contribute towards unleashing the potential of environmental, biodiversity and climate data through dedicated European data spaces. This should allow to exploit the major potential of environmental observation data in support of one or more of the European Green Deal priority actions: climate change, circular economy, zero pollution, biodiversity, deforestation and compliance assurance. Successful proposals are expected to address these challenges and contribute across all environmental areas to help harness the power of big data and artificial intelligence for the benefits of the European Green Deal. The proposals should also help in the convergence of use of high performance computing, cloud, data and artificial intelligence resources for Earth system modelling.

Proposals should contribute to the implementation of the European strategy for data in the domain of environment/climate and could act as a digital enabler for the European Green Deal in those domains. To provide a sustainable perspective for the results achieved, the data and services developed under the proposals should firmly aim to be connected into the common topical European open infrastructure, Destination Earth. Proposals should leverage environmental, geospatial and climate-related data, which are a prerequisite to better understand issues and trends on how our planet and its climate are changing and to address the role humans play in these changes. Proposals should contribute to the release and use of those data to strengthen evidence-based analytical capabilities for policy-making and implementation, including through building on the planned efforts of the European Commission Knowledge Centres on Earth Observation, Biodiversity and Bio-economy hosted at JRC. Proposals should deliver open access to data useful for decision-making by public administrations, investors, insurers, businesses, cities, rural communities, citizen scientists, civil society and citizens, and for the development of new instruments to integrate climate change into risk management practices across the EU. Proposals should build on significant gains in our knowledge over the past decades on data management, to contribute to defragmenting data flows across topics, time and space, and develop best practices in the use of existing relevant platforms such as the Copernicus DIAS and the GEOSS infrastructure, or platforms in development under e.g. Destination Earth, and

communities in order to help prioritise and direct the efforts undertaken in the context of the European strategy for data.

HORIZON-CL6-2021-FARM2FORK-01-11: Digital transition supporting inspection and control for sustainable fisheries

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €4M each.
- Submission deadline: 6.10.21.

Expected Outcome:

In line with the European Green Deal objectives, Common Fisheries Policy, the farm to fork strategy for a fair healthy and environmentally friendly food system, and the blue growth strategy, the successful proposal will support better fisheries management through data and technological development. Project results are expected to contribute to some or all of the following expected outcomes:

- Advancing the digital transition for fisheries inspection and control and deliver data for fisheries science, management and monitoring in a cost-efficient way to fully achieve the objectives of the Common Fisheries Policy (CFP).
- Delivering innovative technological solutions such as machine learning and artificial intelligence and advance sensing technologies to support biologically complex data analysis
- Devise new monitoring and control strategies to stop illegal, unreported and unregulated fishing (IUU) and promote sustainable fisheries in the EU and globally.
- Create a new generation of jobs in the EU requiring digital and high-tech know-how applied to fisheries.
- Improve the professional skills and competences of those working and being trained to work within the blue economy.

Scope:

The CFP aims to ensure that fisheries are environmentally, economically and socially sustainable and provide a source of healthy food for EU citizens. The CFP adopts a cautious approach, which recognises the impact of human activity on all components of the ecosystem. It seeks to make fishing fleets more selective in what they catch, to phase out the practice of discarding unwanted

fish and to fight IUU vigorously. These illegal practices deplete fish stocks, destroy marine habitats, distort competition, put honest fishers at an unjust disadvantage and weaken coastal communities, particularly in developing countries. The EU is working to close the loopholes that allow illegal operators to profit from their activities. To be successful, the EU needs to have in place a technologically advanced and effective fisheries control system. Fighting IUU requires global cooperation, namely through regional fisheries organisations, to foster synergies by adopting innovative control technologies and data standards by fishing, coastal, port and consumer states.

Despite the advances attained since its inception, important challenges remain to ensure that the CFP aims are fully met. The availability and quality of fisheries data should be improved and more needs to be done to ensure that these data are shared systematically between all relevant entities, including fisheries scientists. In the EU, current control measures are only partially effective at ensuring the enforcement of the landing obligation, and of fully documented fisheries more generally. Accurate recording and accountability of by-catches of sensitive species, such as birds and mammals, and of marine biological resources are essential for an ecosystem approach to fisheries and for a sound stock assessment, which are in turn the foundation of responsible and sustainable fisheries management. The control and monitoring of vessels operating outside EU waters (long-distance fleet) as well as the small-scale fleet and recreational fisheries need particular attention.

Moreover, in order to ensure that EU fish imports come from sustainable fisheries and to promote the eradication of IUU worldwide it is necessary to cooperate with third-countries and international organisations to strengthen and promote the use of similar cost-efficient control technologies and data standards. The digital revolution has to contribute to ensure accurate catch registration data, including from weighing at landing, the verification of measures on fishing capacity applicable to vessels engine power, better traceability of fisheries products and improved catch certification schemes.

Digitisation and advanced tools applied to fisheries, such as Remote Electronic Monitoring Systems (REMs), artificial intelligence, machine learning tools, sensor data and highresolution satellite imagery, have enormous potential to optimise fishing operations and enhance our ability to collect and analyse data, as well as improve monitoring and control capabilities and ultimately support a sustainable management of marine biological resources.

Research and innovation under this topic should review existing and develop new technological solutions to improve: (i) detection of illegal discards; (ii) checks on weighing, weighing systems and accurate catch registration; (iii) data management and reporting and third-party reporting based on remote electronic monitoring systems on vessels; (iv) risk management applied to fisheries; (v) monitoring and control of small-scale, recreational and long-distance fleet, (vi) electronic marking of fishing gear, (vii) identifying IUU activities as well as fisheries products

stemming from those activities, (viii) promoting data standards and protection, remote access to data and automatic data exchange protocols, and (ix) innovative tools to assess compliance with technical requirements and measures applicable to fishing vessels, such as continuous engine power monitoring.

Research under this topic should be cross-disciplinary bringing together marine scientists, maritime (including fisheries) surveillance and control authorities, IT specialists and governance experts.

Where relevant, proposals may seek synergies and capitalise on the results of projects funded under Horizon 2020, Horizon Europe, European Maritime and Fisheries Fund, its continuation European Maritime, Fisheries and Aquaculture Fund, and other funding streams.

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

HORIZON-CL6-2022-FARM2FORK-01-04: Innovative solutions to prevent adulteration of food bearing quality labels: focus on organic food and geographical indications

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €4M each.
- Submission deadline: 15.2.22.

Expected Outcome:

The farm to fork strategy aims to accelerate the transition to sustainable farming and food systems by, inter alia, promoting the growth of organic farming with a view to achieve the target of at least 25% of the EU's agricultural land under organic farming by 2030. Moreover, the strategy envisages the strengthening of geographical indications (GIs), by including specific sustainability criteria, where appropriate. One of the strategy's main priorities is to combat food fraud along the food supply chain. The successful proposals should therefore contribute to preventing food fraud of products with quality labels, in particular organic and GIs. In this way, they should facilitate progress towards the strategy's challenging target for organic farming and strengthen the GIs scheme.

Projects results are expected to contribute to all of the following expected outcomes:

- a wider use of new and improved tools and field-deployable methods and approaches for rapid and cost-effective verification of claims related to food products of plant and animal origin with quality labels, in particular organic and GIs;
- unlocked potential of new technologies and other innovative approaches (e.g., business models) fit for farmers and food businesses (especially small-scale farmers and small and medium-sized enterprise (SMEs)) as well as policymakers, which cost-effectively enable traceability and transparency along the supply chains of quality labelled food, in particular those with organic and GIs labels;
- improved functioning and effectiveness of the control systems in Member States and Associated Counties and the EU's legislative framework for organic and GI food products;
- increased data availability, interoperability and use, and improved analytical capacity for enhanced traceability and transparency along the supply chains of quality labelled food, in particular organic and GIs;
- well-informed decision-making by farmers, food businesses and policymakers to improve climate, environmental, economic and social sustainability along the supply chains of quality labelled food, in particular organic and GIs.

Scope:

Quality labelled food products, such as organic and GIs, are generally more expensive than their counterparts. Therefore, foods with such quality labels are particularly prone to fraud. Illegal practices can considerably harm the quality schemes, as they can undermine consumer confidence, thus damaging the farmers and food businesses who respect the rules. The main challenge is that it is difficult for consumers and operators across supply chains to visually distinguish genuine from false organic or GI products. Traditional methods of determining food quality are time consuming and usually require special laboratory analyses, which are often costly and may not be sufficient to guarantee a product's authenticity and traceability. In addition, as organic and GI food supply chains become more complex, the need to ensure product traceability and transparency along the entire chain increases. Existing traceability and control systems help track products throughout the food supply chain and improve transparency. However, the organic and GI sectors rapidly change due to, for example, widespread use of e-commerce, and given the expected growth of these sectors, the risk of fraud may increase. Therefore, it is important to continuously innovate and upgrade the approaches to prevent fraudulent practices. Diverse new technologies and other innovative solutions (e.g., business models; participatory certification; local, short or mid-tier supply chains; etc.), are emerging to improve the authentication and traceability of quality labelled food products, in particular those with organic and GI labels, as well as to increase transparency of supply chains, thereby contributing to combating fraud. These innovative solutions need to be developed/improved, tested, demonstrated and deployed.

Proposals should investigate the current fraud practices affecting quality labelled food products, in particular organic and GI, and analyse the root causes/drivers of these practices and obstacles and ways to eradicate them. Based on these insights and building on the stateof-the-art in research and innovation, proposals should develop/improve, test, demonstrate and pilot promising innovative low-cost methods, tools and approaches to authenticate and/or trace quality labelled food products, especially organic and GIs, as well as to improve

transparency of their supply chains from farm to fork. They should explore the potential of various technological and non-technological innovative solutions (e.g., digital (such as photonics, artificial intelligence (AI), blockchain, internet of things (IoT), machine learning, etc.), new business models (in particular involving and suitable for small-scale farmers and SMEs), suitable reference materials, rapid and field-deployable, non-destructive testing methods, technologies to improve cybersecurity, etc.), and their combinations. The heterogeneity of products and sectors, as well as the diversity of supply chains and contexts should be taken into account. Proposals should also investigate the barriers and incentives to scaling up the use of the innovative solutions as well as assess the positive and negative impacts on the different operations and actors in the organic and GI food value chains, particular attention should be paid to small-scale farmers, SMEs and consumers, as well as the control systems used in Member States and Associated Countries. Proposals should also develop a system to increase availability of and access to relevant data, promote data harmonisation and improve the ways in which data are stored. In addition, they should explore ways to advance the analysis, use, interoperability and security of data to enhance fair transparency and support better decision-making, to improve sustainability along organic and GI food supply chains.

The innovative solutions should be widely disseminated and recommendations for relevant actors in the public sector and business should be provided. Close involvement and consultation with project advisory board members is recommended. Projects should use the 'multi-actor approach', ensuring adequate involvement of all relevant actors, including input suppliers, farmers and SMEs. Proposals may build on existing research infrastructures, where relevant. Proposals are encouraged to build on past and ongoing EU-funded research and innovation projects, and are strongly encouraged to cluster with upcoming projects under the HORIZON-CL6-2021-FARM2FORK-01-10, HORIZON-CL6-2022-FARM2FORK-01-11 and HORIZON-CL6-2021-FARM2FORK-01-17 topics. They are also encouraged to cooperate with actors working on related initiatives, including the European Commission's Joint Research Centre (JRC) Knowledge Centre for Food Fraud and Quality, which provides expertise in food science, authenticity and quality of food supplied in the EU. The possible participation/contribution of the JRC in the project would consist of ensuring that the project deliverables are compatible with and/or improve existing databases and tools used at the European Commission and fostering open access to project results via dissemination through the European Commission Knowledge Centre for Food Fraud and Quality.

This topic should involve the effective contribution of SSH disciplines. For this topic, the integration of the gender dimension (sex and gender analysis) in research and innovation content is not a mandatory requirement.

HORIZON-CL6-2022-COMMUNITIES-01-05: Assessing the socio-politics of naturebased solutions for more inclusive and resilient communities

Essentials in a nutshell:

- Circa 2 projects are expected to be funded, for €6M each.
- Submission deadline: 15.2.22.

Expected Outcome:

A successful proposal will contribute to the EU's goal of leading just digital, economic and ecological transitions that will leave no one behind, supporting in particular European Green Deal priorities such as the biodiversity strategy for 2030. R&I will contribute to develop rural, coastal and urban areas in a sustainable, balanced and inclusive manner thanks to the deployment of nature-based solutions (NBS) 359 and to a better understanding of the environmental, socio-economic, behavioural and cultural drivers of change. R&I will also further support the empowerment of communities to deploy NBS to adapt to climate change and turn digital and ecological transitions into increased resilience, well-being and positive long-term prospects, such as jobs for all (including for women, young people and vulnerable groups).

Project results are expected to contribute to all of the following expected outcomes:

- Enhanced contribution of nature-based solutions (NBS) to social and economic targets, especially in vulnerable communities and notably regarding the transformative change needed to address the biodiversity and climate crises.
- New NBS governance models and co-creation approaches and tools, as well as NBS design and technologies that enhance social benefits while providing ecological and economic benefits.
- NBS are better suited to respond to different socio-political contexts and have higher replicability in the diverse environmental, economic and social conditions across Europe.

Scope:

Nature-based solutions (NBS) are already being delivered with increasing evidence on their effectiveness, but implementation issues persist, hindering NBS uptake and upscale. There is a

need to move beyond seeing the implementation challenge as primarily a technical issue, to develop our understanding of the economic, social, political, moral and cultural dimensions of designing and implementing NBS.

Most of the available approaches seem inadequate to fully take into consideration synergies and trade-offs among different actions, notably in what concerns the social and cultural benefits of NBS. They often also fail to understand the social, political and institutional contexts and the material and discursive elements that shape NBS implementation. This, in turn, affects the long-term success of NBS, notably in contributing to the transformative change needed to address the biodiversity and climate crises. This understanding is particularly crucial when implementing NBS to support vulnerable communities and regions to cope with transformative change in old-industrialised, low-income, outermost or disasterhit areas. NBS can also contribute to addressing inequities and well-being in communities and regions who need it most, especially in terms of the post-COVID19 recovery. Additionally, our understanding of how diverse actors – who may operate at different scales and through multiple networks – are engaged in the development and implementation of NBS is still limited, especially when the deployment of NBS implies collaboration across different regions, administrative areas or simply different types of land owners.

The successful proposals should:

- Gain a wider understanding of the role of actors involved in NBS, considering: a) particular groups of actors that have been under-researched (e.g. land holders such as churches, charitable organizations, educational establishments, utilities, etc.); b) sectors of the economy (e.g. agriculture, forestry, tourism, finance, etc.) and c) landscapes (e.g. coastal areas, river catchments, wetlands, etc.);
- Investigate how different NBS designs and governance can contribute to environmental justice, prevent environmental racism and gentrification, insure the inclusion and active participation of women, youth, minority groups, immigrant communities, etc.;
- Develop innovative governance models: a) exploring different forms of engagement, inclusion and stewardship; b) enabling the breaking of silos in public administration and between different administrative domains; and c) tackling other legal, management and administrative issues;
- Propose ways in which NBS governance and design can contribute to transformative change and to a just transition in support of the Sustainable Development Goals;
- Understand and propose solutions to functional conflicts in land-use for better and more integration between NBS, land-use planning and other (possibly conflicting) sectors, their policies and planning processes;

- Explore governance techniques (e.g. standards, certification, incentives, subsidies, etc.) that develop private and voluntary governance alongside formal regulatory and planning powers, with a view to mainstreaming NBS in the public and private sectors.
- Identify the possibilities for, and limits to, the full co-creation approach in NBS (including co-design, co-implementation, co-maintenance and co-monitoring), their underlying governance arrangements and instruments;
- Provide approaches based on citizen science, big data or artificial intelligence tools to better communicate the science of NBS and promote citizen engagement in the cocreation, co-implementation and co-monitoring of NBS;
- Understand how the meanings and values attached to nature in urban, rural, coastal, periurban or post-industrial areas affect the long-term success of NBS. To this end, investigate what counts as nature, what is valued and why this varies amongst individuals and communities as well as how this can be taken into account in the development of NBS.
- Investigate the impact of citizens' perceptions and expectations towards NBS on management decisions and delivery of ecosystem services, while considering also the role of NBSs in generating new kinds of connections and values for nature and with what consequences.

Proposals should address all of the above points. Proposals should bring together from the start multiple types of scientific expertise in both natural sciences and social sciences and humanities (e.g. geography, sociology, political ecology, behavioural sciences, anthropology, philosophy, etc). In particular, this topic should involve the effective contribution of SSH disciplines.

Projects should seek to contribute to the New European Bauhaus initiative by supporting the green and digital transitions in communities' living environments through merging sustainability, inclusiveness and quality of experience. Small-scale pilots could be envisaged to explore NBS which are innovative either in their functional scope, socio-economic reach, integrative approaches or application in new settings.

Applicants should create synergies with projects under the same topic and other relevant ongoing or up-coming projects, notably the Horizon 2020 NBS project portfolio and its task forces; HORIZON-CL6-2021-BIODIV-01-05: The economics of nature-based solutions: costbenefit analysis, market development and funding; HORIZON-CL6-2021-BIODIV-01-06: Nature-based solutions, prevention and reduction of risks and the insurance sector; HORIZON-CL6-2022-BIODIV-01-03: Network for nature: multi-stakeholder dialogue platform to promote nature-based solutions; HORIZON-CL6-2022-COMMUNITIES-02-02- two-stage: Developing nature-based therapy for health and well-being; HORIZON-CL6- 2021-COMMUNITIES-01-06: Inside and outside: educational innovation with nature-based solutions. To this end, proposals should

include dedicated tasks and appropriate resources for coordination measures, foresee joint activities and joint deliverables.

Proposals should ensure that all evidence, information and project outputs will be accessible through the Oppla portal (the EU repository for NBS).

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

In order to achieve the expected outcomes, international cooperation is strongly encouraged, in particular with the Latin American and Caribbean region and the USA.

Widening participation and strengthening the European Research Area cluster

Topics summary

Topic name	Deadline	Funding per project
HORIZON-WIDERA-2021-ERA-01-33: R&I intensive IP management: Scenarios for the future	23.9.21	€1M

HORIZON-WIDERA-2021-ERA-01-33: R&I intensive IP management: Scenarios for the future

Essentials in a nutshell:

- Circa 1 project is expected to be funded, for €1M.
- Submission deadline: 23.9.21.

Expected Outcome:

Projects are expected to contribute to the following expected outcomes:

- A mapping of the forthcoming technology process trends and the IP framework relevant for R&I that will go with these
- An assessment of the current intellectual property methods and how fit for purpose they are taking into account the transformation of research results into markets / socioeconomic benefits
- Development of scenarios with potential new protection mechanisms that will benefit both the research community and society.
- Set of guidelines to R&I actors, notably the research generators, for the protection and use of intellectual property assets.
- Set of recommendations for policy makers regarding the future needs for framework conditions relevant for R&I.
- Establishment of a communication channel with the aim of promoting an open dialogue on R&I driven intellectual property needs, bringing together various stakeholders and practitioners and providing a feedback loop between practitioners and policy makers regarding emerging needs.

Scope:

Technology sovereignty requires, together with investment, an in-depth understanding of the research and innovation landscape. The current Open Innovation strategies, the ever growing Open Science practices and the artificial intelligence revolution create an ecosystem where the innovations happen faster than ever (machine learning, big data etc.). This topic will look at ways to overcome the existing gaps researchers have to face when following unconventional discovery methods (e.g. artificial intelligence, computer inventions etc.).