

Scoping Paper for
Horizon 2020 work programme 2018-2020
Societal Challenge 5: Climate action, environment,
resource efficiency and raw materials

Important Notice: Working Document

This scoping paper will guide the preparation of the work programme itself. It is a working document not formally endorsed by the Commission, and its content does not in any way prejudge the final decision of the Commission on the work programme.

The adoption and the publication of the work programme by the Commission are expected in October 2017. Only the adopted work programme will have legal value.

Scoping paper for the Horizon 2020 work programme 2018-2020

Societal Challenge 5: Climate action, environment, resource efficiency and raw materials

1. Context

The strategic priorities identified for 2018-2020 will continue to pursue Societal Challenge 5 (SC5)'s overall objective of helping to realise a green economy, i.e. a circular, climate-resilient economy in sync with the natural environment, thereby contributing to achieving smart, sustainable and inclusive growth. They address the ambitious targets set recently at global level by the COP21 Paris Agreement, the UN's Sustainable Development Goals (SDGs), the global Urban Agenda adopted in Quito and the Sendai framework for Disaster Risk Reduction, which demand a fundamental shift in technology, economics, finance and society as a whole, and help implement high-level EU policies including the 7th Environmental Action Programme to 2020, the Circular Economy, the Energy Union (including the Communication 'Accelerating Clean Energy') and the Arctic. All of these put special emphasis on science and innovation as critical drivers for achieving the long-term goals and targets. At the same time, activities will contribute to the Commission's priorities of 'Jobs, Growth and Investment', 'Energy Union and Climate', 'Digital Single Market' and 'Stronger Global Actor', through a process underpinned by open science and open innovation, and which is open to the world and attentive to ethical and gender issues.

Evidence-gathering to support the selection of priorities included a targeted, on-line stakeholder consultation. The 200 responses received, the majority as official positions of organisations, indicated substantial adhesion to the evolution of the previous two SC5 work programmes (WPs) from funding of a collection of research actions to a policy-driven, strategic investment in an innovation portfolio, in line with the spirit of Horizon 2020, as well as to the strategic priorities covered hitherto. Nevertheless, the balance between support for traditional research and for solution-oriented innovation projects was appreciated differently. A strong call was also registered for a number of well-framed accompanying measures to carry out analysis to better understand rapidly-evolving issues and more effectively target future action. The consultation was supplemented by dialogue with the European Innovation Partnerships (EIPs) Water and Raw Materials, Climate-KIC, EIT Raw Materials and relevant ETPs, by two workshops bringing together JPIs and ERA-NETs with close links to SC5, and by perusal of the European Environment Agency's SOER 2015 'The European environment – state and outlook 2015'.

The SC5 Expert Advisory Group (AG) submitted its report on 1st June 2016. This identified five strategic priorities for the period 2018-2020, together with a clear overview of the desired outputs and outcomes: climate action after COP21; circular economy; innovative and resilient cities and rural areas; the water-food-energy nexus; enabling systemic transformation. It also identified important additional cross-cutting issues (including raw materials) and noted that the cross-cutting nature of SC5 necessitates an integrated approach and complementarity with other WP parts to maximise overall impact. The AG stressed the importance of creating enabling conditions for transformative change, supported by R&I for expansion of the knowledge base, deployment and scale-up of technical, nature-based and socio-economic solutions, and better monitoring and analysis of transformation. This requires greater understanding of behaviour, socio-cultural dynamics, change and the systemic potential of sustainable lifestyles. To ensure societal engagement and acceptance, multi-stakeholder actions should be initiated.

The Commission services also assessed the coverage of the SC5 objectives in the Horizon 2020 Specific Programme (SP). The analysis showed that projects funded under WP 2014-2015 and the topics included in WP 2016-2017 were in line with the overall aims of the Specific Programme and showed great progress towards fully addressing its objectives. To optimise the use of resources and create synergies between activities, projects/topics had frequently been designed to address more than one objective. No major gaps in coverage were revealed; a few areas were less well covered (for instance, specific issues relating to geo-hazards or cultural heritage) or merited more specific attention.

In recent years, the international setting for scientific cooperation has evolved significantly, with the increasing importance of thematic or objective-driven partnerships (e.g. supporting trans-disciplinary research, research/policy interface) rather than bilateral or bi-regional geographical ones. In the context of SC5, key partnerships have been established recently with the international Belmont Forum of funding agencies for research on environmental change (co-chaired by the European Commission), the Future Earth initiative for global sustainability research, the S&T Alliance for Global Sustainability Research and the Group on Earth Observation (GEO), and are to be embedded in future actions.

2. Strategic priorities for 2018-2020 and translation into calls

2.1 Climate action in support of the Paris Agreement

The historic Paris Agreement (PA) sets out challenging long term goals to put the world on track to limiting global warming to "well below 2°C above pre-industrial levels" and "pursuing efforts" to limit warming to 1.5°C, requiring trajectories going towards climate neutrality this century, while at the same time increasing the ability to adapt to the adverse impacts of climate change. R&I will therefore focus on supporting the implementation of the PA, helping understand its mitigation and adaptation goals, and producing relevant scientific knowledge in advance of key PA-related milestones, such as the publication of national mid-century strategies (2020), the 6th assessment cycle of the IPCC (2018-2022) and the first global stock-take in 2023. Actions will also support relevant EU policies and objectives, such as the Energy Union, Arctic policy, EU Adaptation Strategy and EU climate diplomacy efforts. Special consideration will be given to cooperation with strategic partner countries/regions. In particular, actions will focus on:

- i) policy-oriented research into decarbonisation (including opportunities, costs, impacts, trade-offs, behavioural aspects, approaches and solutions for negative emissions to move towards climate neutrality, links with adaptation and other policies such as air quality) consistent with the PA goals and which preserves the EU's position as a front-runner in the 'green race' for low or zero carbon products, solutions and services. This will include focus on critical sectors such as land use and agriculture as well as how they relate to the implementation and further development of Nationally Determined Contributions (NDCs), in particular in strategic partner countries;
- ii) in-depth assessments of impacts, vulnerabilities and risks for enhancing resilience of human systems and ecosystems and climate-proofing of assets, sectors and critical infrastructures in support of decision making; facilitating market development of climate services; development and application of methodologies and tools for assessing climate risk in investments, businesses and the private sector;

- iii) enhancing, understanding and supporting the development and use of nature-based solutions, green and blue infrastructure and ecosystem-based approaches to decarbonisation and climate change mitigation, adaptation and resilience;
- iv) providing robust assessments of the impacts of climate change on vulnerable areas/hot-spots such as oceans and the cryosphere (with the main focus on the Arctic) and associated planetary feedbacks, as well as developing solutions for adaptation and sustainable development;
- v) science to address emerging issues and key knowledge gaps, enabling long-term improvement of climate science with a view to producing policy-relevant information for mitigation and adaptation.

2.2 Circular economy

Further development of a sustainable, resource efficient and competitive economy will require a transition to a more circular economic model, with products, processes and business models that are designed to maximise the value and utility of resources while at the same time reducing adverse health and environmental impacts. The Commission's Circular Economy Communication states that "support of R&I will be a major factor in encouraging the transition". R&I actions on the circular economy are closely linked to key EU priorities, including those addressing jobs, growth and investment, climate and energy, strengthened industrial base, and to global efforts on sustainable development.

Innovation actions, complemented by R&I actions, will address the full range of product lifecycle stages, starting from design, in order to reduce the quantities of raw materials in production and consumption and facilitate the use of secondary raw materials. Attention will be paid to product durability, for instance through methods to test for planned obsolescence. Potential risks, side-effects and regulatory challenges resulting from circular economy approaches will be duly considered. Priority areas will include plastics, critical raw materials, construction and demolition, and water use and reuse. Research will also investigate the consequences of transition to the circular economy, in order to identify policies that can effectively support the transition and mitigate its potential adverse effects. Aspects such as public acceptance and collaborative economy models will be considered. Greater integration of digital solutions in support of the circular economy will be essential.

Actions are expected to improve the efficiency and effectiveness of resource use, substantially reduce the generation of residual waste and thus reduce adverse environmental/climate effects. New business opportunities for enterprises, including SMEs, are expected. Acceleration of progress and stimulation of a global market may also be pursued via international cooperation.

2.3 Water for our environment, economy and society

Changes in water availability and the frequency of floods and droughts due to climate and other environmental changes, growing pollution trends and emerging contaminants in water, increased competition in water use for environmental protection, business continuity, energy, agricultural production and food security, and increasing urbanisation all require the development and implementation of robust, smart water management systems, tailored water-smart solutions and effective multi-sectoral governance models. Moreover the digital era, which is transforming all aspects of society, the economy, knowledge management, behavioural patterns and governance, should be harnessed in the development of systemic, innovative water solutions.

R&I will support and accelerate the implementation of EU water, resource efficiency and water-dependent industrial policies and initiatives. It will also contribute to the EU's policies on the Energy Union, climate action and the digital economy, while strengthening international collaboration and partnerships on water-smart solutions, technologies and governance, and thereby also supporting Europe in achieving relevant commitments under the UN's 2030 Strategy for Sustainable Development.

Actions will focus on realising the true value of water, i.e. to boost both the EU water market and the global competitiveness of the EU water sector and water-related/-dependent industries and economic sectors, and to secure the long-term resilience, stability, sustainability and security of the environment, public health and human well-being. They will address innovative water technologies, services and monitoring tools, digital solutions, living labs and large scale demonstration projects with various water uses (industrial, urban, rural and agricultural) and at various scales (regional/national/international river basins) and integrated approaches, including nature- and ecosystem-based solutions, recognizing the critical nexus between water, energy and food and the complex interactions between ecosystems and human activity, especially in a changing climate. R&I actions to improve risk and impact assessments related to the above-mentioned challenges, and actions promoting water diplomacy with key international partners and regions (e.g. for the management of trans-boundary river basins) and developing inclusive, multi-stakeholder business and governance models and decision support systems that contribute to solving water challenges in Europe and beyond will also be addressed, including actions to support the implementation of the PRIMA initiative (Partnership for Research and Innovation in the Mediterranean Area).

2.4 Innovating cities for sustainability and resilience

Cities are the home of complex, inter-dependent challenges related to resource depletion, climate change impacts, environmental degradation, pollution, health issues and social exclusion. The role of cities as key actors and incubators for innovative solutions that tackle these challenges has been acknowledged in the new Urban Agendas globally and for the EU. A systemic and cross-sectorial 'urban ecosystem' approach is needed to design and implement solutions to the multifaceted challenges.

The main objective of this priority is to help design, implement and upscale place-based and people-based transition pathways towards resilient, sustainable, low-carbon and resource efficient cities. The emphasis will continue to be on nature-based solutions (NBS) as inherently integrated, cross-sectorial, resource efficient and adaptable interventions that can help ensure sustainable, liveable, resilient and healthy urban areas, in sync with their peri-urban and rural surroundings. Building on the momentum created by cities' active engagement in implementing the above-mentioned international agreements and the positive response from cities to the Smart and Sustainable Cities call 2016-2017, this priority will continue to invest in large scale demonstration projects, with cities acting as 'living labs' and engaging stakeholders in open innovation and co-creation to develop, test and replicate in real-world conditions innovative NBS with market potential and integrated urban planning. Actions will aim for optimal use of ICT, Earth observation and big data handling platforms for cost-effective monitoring schemes, decision making tools and improved services to citizens. The knowledge and evidence base thus produced will enhance the replicability and market potential of these solutions in diverse urban contexts across Europe and globally. Emphasis will be on NBS for air, noise and water quality, climate adaptation and decarbonisation, human health and well-being, and disaster risk

reduction in cities, encompassing all forms of innovation (technological, digital, social, institutional, financial, regulatory and governance).

Complementary research actions will better quantify the benefits of NBS in cities. New types of partnerships (including public engagement, public-private partnerships, citizens' science and networking with international city networks and strategic international partners) and instruments (such as public procurement, inducement prizes and natural capital accounting) will be tested for their potential to further promote creativity, replicability and market uptake of the solutions in Europe and worldwide. Synergies with other relevant parts of H2020 will be sought to promote integrated approaches to improve urban ecosystem functioning, combining 'hard' (such as energy, transport), 'soft' (such as active mobility, data, ICT, sensors) and environmental systems (habitats, green space and green infrastructure).

2.5 Raw materials

Raw materials are crucial for a strong European industrial base, an essential building block of the EU's growth and competitiveness. Projections indicate that future global resource use could double between 2010 and 2030. The SC5 AG report also considers that R&I for sustainable access to and use of primary and secondary raw materials will continue to play a fundamental role in maintaining the competitiveness of industry, facilitating the transition to a circular economy and developing low carbon technologies. However, the EU is confronted with a number of challenges along the entire raw materials value chain to secure a sustainable access to non-energy non-agricultural raw materials used for industrial purposes, including an increasing number of Critical Raw Materials (CRM).

This priority will address these challenges, which are best solved at EU level, through implementing the relevant parts of the EU Raw Materials Policy, the Strategic Implementation Plan of EIP on Raw Materials, the EU's Industrial Policy, the 'Innovation Union' and 'Resource Efficiency' flagship initiatives, the Blue Growth Strategy and the Circular Economy package.

Actions will cover the entire EU raw materials value chain, from sustainable exploration (including sea-bed), extraction, processing (including metallurgy) to recycling, as well as substitution of CRM. In an 'open innovation' approach, actors from the whole EU raw materials innovation chain will be involved, including researchers, industry, end-users, public authorities and civil society. The main focus will be on supporting the targets of the EIP on Raw Materials, including large innovative actions for EU raw materials production, including end-of-life products recycling and use of ICT enabled solutions, and an integrated EU raw materials knowledge base. Breakthrough research concepts, as the basis of tomorrow's innovations, will also be tackled through smaller, lower-TRL actions. Policy-related actions will aim at improving raw materials framework conditions and improving environmental and social aspects, including awareness, acceptance and trust of society, which requires long-term investment. The use of ICT-enabled solutions will also be promoted. In an 'Open to the World' approach, actions will be launched with the strategic partners mentioned in the Raw Materials Strategy for International Cooperation, such as Australia, Brazil, Canada, Chile, Colombia, Japan, Mexico, USA and South Africa.

In the short to medium term, actions are expected to: improve our knowledge of natural resources (sources and uses), deliver innovative pilot plants demonstrating sustainable production of both primary and secondary raw materials, including CRM; integrate the raw materials knowledge base for solid decision making; improve the framework conditions for the

sustainable development of and investment in innovative solutions in the EU. In the long term, actions should positively impact on: downstream industries' access to raw materials; employment in and competitiveness of the EU raw materials and related manufacturing industries, including SMEs; the environmental and social performance of the primary and secondary raw materials producers; and improved public awareness, acceptance and trust.

2.6 Protecting and valorizing our natural and cultural assets

- Earth observation

The Commission, together with the Member States and other European GEO nations associated to Horizon 2020, is committed to implement GEOSS in line with the new GEO Strategic Plan 2016-2025. The capacity to observe the planet is evolving rapidly, leading to higher volumes of and more diverse data flows from private and public operators (including from citizens). R&I will aim to capitalize on these trends in collaboration with the Copernicus programme to stimulate growth and jobs in Europe in the context of the digital economy (open innovation) and to support decision-making in environmental policy and management and disaster management.

Actions will target the following priorities: i) delivering EO services of the future by exploiting GEOSS, Copernicus and other available EO data and by addressing the full innovation chain from innovative ideas to pre-commercial deployment, focusing on developing and demonstrating innovative mass market applications for businesses and citizens;

ii) developing a regional GEOSS strategy for Europe, leveraging Copernicus, INSPIRE, EMODNet and related European systems, infrastructures and initiatives, to enable and improve capacities for the discovery, access, processing, integration and use of EO data of different types and origins (from space to ground), across platforms and for various communities of users;

iii) contributing to selected GEO flagship activities of high strategic value to the EU and its international commitments (such as the 2030 Agenda for Sustainable Development and the G7).

Combined with ICT advances such as the Internet of Things, big data analytics and cloud processing, these R&I activities will create new business opportunities as part of the digital economy within a structured international framework (open science, open to the world).

- Nature based solutions, disaster risk reduction and natural capital accounting

Actions will support multi-stakeholder, multi-purpose demonstration projects on nature-based solutions to protect and enhance biodiversity and ecosystems, and to increase the resilience of territories to disasters and hazards (such as forest fires, extreme events) and the capacity to restore degraded land, habitats, ecosystems and biodiversity. In addition, actions will be launched in the field of natural capital accounting and its operationalization and use at business and governance levels (e.g. decision making tools) to complement GDP.

Furthermore, R&I will underpin efforts in specific fields such as multi-hazard risk management and cascading impacts, as well as early-warning systems, forecasting, monitoring and reporting capabilities for geo-hazards (such as earthquakes). R&I will also bring insights into optimal use of biodiversity and ecosystems functioning to enhance the performance of the NBS and will explore and showcase the potential contribution and benefits of NBS to the circular economy and resource efficiency.

- Heritage alive

In line with the SDGs on cultural heritage, the recent Commission Communications and related Council conclusions and EP reports, SC5 will pursue the dynamic, future-oriented R&I agenda inaugurated in 2016-2017 and will contribute to the 2018 Year of Cultural Heritage to further valorise cultural heritage as a strategic living resource. The aim is to protect cultural heritage by positioning it at the centre of sustainable development and demonstrating, quantifying and unlocking its potential as a driver for economic growth and job creation, social cohesion and environmental sustainability.

Building on the positive response to 2016-2017 calls, R&I investment will be pursued in large scale 'living labs' demonstration projects, engaging relevant stakeholders in open innovation and co-creation to design, develop, test and upscale innovative designs, strategies and heritage-led services, which optimally integrate natural and cultural heritage with new innovation paradigms and business, governance and financing models. They will provide knowledge and evidence on their social, educational, economic, cultural and environmental impact and thereby enhance their replicability and market potential in various contexts in Europe and world-wide. R&I actions will enhance the capacity to predict, assess and mitigate the direct and indirect impact of global change on cultural heritage. The innovation potential of new types of partnerships, interventions and instruments (inducement prizes and public procurement, international partnerships, cultural heritage diplomacy, skills development and capacity building) will be explored to enhance framework conditions for a global market uptake of heritage based services and solutions. Actions will include international cooperation, also considering the current threat to cultural heritage.

Calls

<i>Call: provisional working title</i>	<i>Scope of the call</i>	<i>Possible contribution to Focus Areas (F.A.)</i>
Climate Action in support of the Paris Agreement	Actions under priorities 'Climate Action in support of the Paris Agreement' and 'Innovating Cities for sustainability and resilience', and some actions under priority 'Water for our environment, economy and society'.	SC5 contribution to F.A. "Building a low-carbon, climate resilient future".
Greening the economy in line with the SDGs	Actions under priorities 'Circular Economy', 'Water for our environment, economy and society', 'Raw Materials', 'Protecting and valorising our natural and cultural assets', and some actions under 'Water for our environment, economy and society'.	Includes SC5 contribution to F.A. "Connecting economic and environmental gains – the Circular Economy"