Scoping Paper for

Horizon 2020 work programme 2018-2020

Societal Challenge 2:"Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy"

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 2:"Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy"

1. Context

Europe is urged to act on key challenges for the years to come: adapt to and mitigate climate change by limiting global warming to well below the 2°C target; ensure food- and energy-security; preserve biodiversity, promote superior alternatives to our fossil-based economies and foster economic growth and social prosperity. It has committed to take action in response to international commitments on Sustainable Development Goals (SDGs), Climate Action (COP21 Paris Agreement), biodiversity (Convention on Biological Diversity - CBD) and the recent G7 declarations on the future of the ocean.

Agriculture and food systems, forestry, the marine and the bio-based sectors are at the very heart of the challenges to be addressed, not only because they are fully impacted by these challenges, but also because they are crucial determinants to drive the evolution of these challenges and find solutions to tackle them. Several SDGs are of direct and immediate relevance to SC2 (e.g. zero hunger, good health and well being, climate action, life below water, life on land, responsible consumption and production, decent work and economic growth, affordable and clean energy, clean water and sanitation). The primary sectors covered by SC2 are important causes of anthropogenic greenhouse gas (GHG) emissions, but at the same time, forests, perennial crops, soils and oceans are major overall carbon sinks. Oceans represent the largest active carbon sink on Earth, absorbing more than a quarter of the carbon dioxide – but we miss sufficient knowledge on their functioning, they are not sustainably exploited and marine ecosystems are endangered by acidification, warming and anthropogenic activities, putting the sink under pressure. The demand for biomass for food, feed, materials, energy and bio-based industries looks set to grow – but there is considerable uncertainty about whether this increase can be met without further deterioration of the ecosystems on which production depends. Diverse modes of agricultural, forestry and aquatic production need to be established and food systems to be transformed to provide healthy and nutritious food while addressing climate change, sustainable land use and maintaining the competitiveness of the food industry. Focused investments under SC2, with a special focus on SMEs, will be essential to provide the game changers needed to properly address these challenges.

SC2 will **focus on the development of resilient and sustainable value chains for food and other bio-based systems. It will help to mitigate and adapt to the risks of climate change and biodiversity loss, demonstrate and sustainably manage the potentials of land, sea and freshwater bodies. It will foster innovation in rural, coastal and urban areas, linking the different needs of territories across Europe with a broad societal engagement**

These investments will **help create new markets and jobs in rural, urban, coastal and offshore areas.** They should promote innovation opportunities in agriculture, food and bio-based industries, driven amongst others by the merging and advancement of digital, physical, and biological science and technologies such as advanced manufacturing and processing. They should allow a **shift**

towards circular economies, making the best use of limited natural and biological resources and they should develop **innovative, sustainable, environment- and climate-friendly flagship solutions on land and at sea**, which will help the EU maintain its global leadership to enable new discoveries and inventions that benefit society as a whole.

This document describes the orientations which will guide the preparation of the 2018-2020 SC2 Work Programme. They have been drafted in order to meet the Commission's political priorities on '**Increased investment in sustainable development and climate related R&I', 'Integrating digitisation in all enabling technologies and societal challenges', 'Strengthening international R&I cooperation', 'Resilience to crises' and 'Market creating innovation',** and ensure that the concepts of Open Science, Open Innovation and Open to the World are fully integrated. Synergies with other parts of Horizon 2020 - especially SC1, SC5 and LEIT - will be sought.

The present scoping paper is the result of a comprehensive, evidence-based exercise. It included a) a mapping of objectives of the Specific Programme against the topics and projects funded in the SC2 and the Bio-Based Industries Joint Undertaking Work Programmes 2014-2017, and b) the identification of needs and gaps based on in-depth analyses of trends and foresights and highlighting in particular the need to bring innovations and technologies closer to the markets. It also reflects the research and innovation (R&I) priorities presented in the Commission's document "A strategic approach to EU agricultural research and innovation"[i]. The Horizon 2020 SC2 Advisory Group and a broad range of external stakeholders were consulted via conferences, workshops, written inputs and targeted as well as open public consultations. These consultations served to enrich the strategic programming process, by providing inter-disciplinary, cross-sectorial and societal-inclusive perspectives.

2. Strategic orientations for 2018 – 2020 and translation into calls

The five orientations set out below are common themes for the whole SC2. Altogether, the themes embed both the issue of resilience into food and bio-based systems, as well as the urgency to increase preparedness and readiness to operate in a rapidly changing world.

The orientations are complemented by a number of horizontal issues including 'Sustainability', 'Systems approaches', 'Open science', 'Enabling knowledge', 'Adapted technologies' and 'Widening participation'. Worldwide efforts are also necessary to join resources and capabilities to gather critical mass and effectively tackle major endeavours in SC2. International cooperation will be encouraged throughout the calls and will ensure that funded activities also benefit less developed countries. Examples include a new South Atlantic partnership towards an 'All Atlantic Ocean Research Alliance' with a future South-South component, a reinforced cooperation on land and at sea with international partners in other regions such as the Baltic Sea, the North Sea, the Mediterranean and the Black Sea. Dedicated activities in the context of the Partnership on Food and Nutrition Security and Sustainable Agriculture (FNSSA) between the EU and Africa, with the Mediterranean Countries (PRIMA) and with Chinese partners will contribute to address the global issue of food and nutrition security. A planned "International Bioeconomy Forum" (IBF) will contribute to a strengthened and common vision at international level for key aspects of the bioeconomy.

Other principles will underpin the programing of the work programme including Responsible Research and Innovation (RRI), multi-actor approach, the gender dimension of research, the inputs from Social Sciences and Humanities (SSH) and the alignment of Member States programmes. They will play a critical role in each of the strategic orientations allowing R&I to address the values, needs and expectations of society

2.1 Addressing climate change and resilience on land and at sea

Addressing climate change is one of the biggest challenges Europe and the world are facing. Important international commitments have been taken in the COP 21 Paris Agreement to limit the expected rate of global warming to "well below 2°C" and thereby dampen predicted adverse effects. Land and oceans are both accountable for GHGs emissions and for carbon sequestration. For this reason, they will be under particular scrutiny to meet climate targets while at the same time expected to continue satisfying the need for food, feed, bio-based products and renewable energy for a global population projected to reach 9.7 billion by 2050[ii].

R&I in SC2 will help to understand and predict the extent and the mechanisms through which climatic variations and global warming are occurring and impacting on agriculture, forests and seas. The capacity of the sectors covered by SC2 to cope with multiple stressors will need to increase. The sectors' mitigation capacity will also be increased to exploit important synergies between mitigation and adaptation efforts, reduce negative impacts and optimise environmental, social and economic benefits. This will include work on Blue Carbon, the role of ecosystems and other nature-based solutions to improve resilience.

Activities will test diversification strategies as a main route towards more resilient and sustainable primary production systems. These will examine the capacity of agriculture and forestry to further reduce GHGs emissions through, for example, soil, crops, livestock and biomass management. As for forestry, there is a need for a thorough understanding of synergies between various mitigation options and adaptation needs and, in general, between climate considerations and other forest functions. Attention will be given to the potential of microbiomes to mitigate negative effects of climate change, increase sustainability, improve resilience and health, and meet global biomass needs, supporting the development of new industries. Attention will be given to the complex interactions between land and sea, and potential synergies or trade-offs between climate adaptation and mitigation measures. As recommended by the G7, actions will aim to improve ocean observation – including those accessible through a European Open Blue Cloud pilot – to better predict sea-level rise, coastal erosion, climate change and the impact of future activities such as deep sea mining.

In the short-medium term, actions are expected to result in climate-smart agriculture, forestry, food and bio-based systems that contribute to the implementation of the COP 21 Paris agreement and SDGs by increasing predictive capabilities in response to global environmental changes while protecting coastal and rural areas, and ensuring human wellbeing. In the long term, they will also contribute to improve health and productivity of land and oceans, protect and restore terrestrial and marine ecosystems, as well as reduce stressors.

2.2 Making the transition towards a circular bioeconomy

Implementing the concepts of the circular economy and bioeconomy will be a major step for a transition to a sustainable, low-carbon and resource efficient economy. They are based on reducing material and resource inputs, maintaining the value of products, materials and resources in the economy for as long as possible, minimising the generation of waste and sustainably replacing non-renewable resources with biomass[iii].

R&I across all SC2 sectors will support resource-efficient production, processing, distribution systems and value-chains based on new business and governance models. Activities will explore how to ensure sustainable supply of feedstocks while minimising losses and waste throughout primary production, the food chain and bio-based industries. Social innovation will be promoted as a driver for user-centric solutions.

Activities will aim at protecting oceans and land from waste and litter by remediating existing concentrates, mitigating new pollution and developing biodegradable bio plastics. At the same time, activities under SC2 will develop new avenues for putting in place the '3R principle' of Reducing, Reusing and Recycling. Funding efforts will strengthen the linkages between rural, coastal and urban resource flows and foster more diverse farming models with optimised nutrient flows on and across farms.

In the long term, these actions will support the competitiveness of primary sectors, bio-based industries, the sustainable development of European bio and blue economies. In the short-medium term they will develop resource-efficient and circular processes in agriculture, forestry and the food industry, advance the concept of industrial biorefineries and integrate the sustainable production of food, feed, bio-based products and energy.

2.3 Functional ecosystems, sustainable food systems, healthy lifestyles.

Ensuring long-term food and nutrition security and sustainability of food systems requires sustainable management of land, soil and water, and genetic resources as providers of terrestrial and aquatic[iv] ecosystem services upon which rely primary production practices, which are at the basis of the whole food chain, nutrition, lifestyle and health.

Investments in R&I will future-proof our food systems to make them more sustainable, resilient, responsible, diverse, competitive and inclusive. They will look at healthy and productive ecosytems and food systems as an overarching theme to address the nexus between the management of (natural and biological) resources and ecosystems, the environmental, economic and social impacts of production systems, plant and animal health and welfare, food quality and safety, nutrition, lifestyle and health. Harnessing the potential of microbiomes from soils, plants, animals, the marine and humans will offer major opportunities for increasing sustainable primary production while reducing negative environmental impacts and enhancing food safety and quality, nutritional values and health. Activities will also tap into the potential of agricultural and aquatic production to deliver sufficient, safe and high-quality food, feed and wider public goods to strengthen the sustainability and resilience of farming systems. They will improve post-harvest storage and transport to reduce contamination in the agri-food chains and have a major impact on food safety and health. The sustainable production of marine proteins and other novel healthy food protein sources as a growing new part of our diets will help to sustainably feed our citizens (and the world) by 2030.

Activities will support genetic resources and agro-ecosystems to improve the diversity, resilience, robustness, and efficiency of animal and plant production from land and sea, provide quality food and contribute to health benefits through more balanced diets. Following the 'One Health' principle[v], SC2 will develop a holistic approach to better understand, prevent and manage diseases. Sustainable fisheries and aquaculture will deliver solutions to increase yields and integrate exploitation of diverse marine biomass resources, such as assessing the possibility of fishing lower in the trophic chain and setting up innovative aquaculture production systems. Efforts will require highly inter- and trans-disciplinary cooperation, systems and multi-actor approaches and major contribution by social sciences and humanities.

In the short-medium term, actions will enhance the sustainability of food systems and deliver a better alignment with public health and ecosystem management. In the long term, they will contribute to the creation of jobs and economic growth by engaging all stakeholders from producers to consumers.

2.4 Boosting major innovations on land and sea – new products, value chains and markets

Innovation is at the core of EU policies. In particular, several European Innovation Partnerships (EIPs) have been developed as part of the Europe 2020 strategy. Among those, the EIP "Agricultural productivity and sustainability" aims to boost innovation through a process of knowledge co-creation implemented with the multi-actor approach[vi].

Testing, demonstrating and scaling-up new technologies, processes and business models that create breakthrough innovation are of outmost importance to ensure long-term competitiveness for the primary and secondary sectors covered by SC2. However, scaling up technologies represents a significant commercial risk for private investors. Therefore, public investment is essential in creating new, sustainable value chains that will encompass new jobs, products and services.

Activities in SC2 will also target high Technology Readiness Levels (TRLs), in the form of demonstrators that combine new materials, products, technologies, processes and services. Investments will exploit the high innovation potential of some of the emerging sectors of the blue economy: algae biorefineries, offshore multi-use platforms, bioprospection, bio-mimicry and the production of novel marine-derived biomolecules. To further advance innovation, they will also use the leverage of a combination of different Horizon 2020 instruments.

Investments will also exploit the high innovation potential of Industry 4.0[vii] in the food sector, as a fusion of physical, digital, and biological technologies. They will test and scale up a wide range of technologies and approaches including ICT, adapted and future emerging technologies as well as nature-based solutions to improve and diversify practices in primary production, the organisation of food and non-food industries, the traceability of products and services, and ultimately engage consumers and society in value chain processes. They will also push back frontiers in areas such as alternative feeds and proteins, food cities, personalised nutrition, the microbiome, food processing technologies, food chain data, active and intelligent packaging, conscious food choices, value from waste, aquaculture expansion, smart low-input systems, new skills and standards for sustainablility and traceability.

In forestry, there is a need for coherent R&I along the value chains, on sustainable production of biomass and further development of bio/wood-based products (e.g. building with wood), including citizens views, governance/public policies, and trade.

In the short-medium term, actions will create a broad innovation ecosystem. They will enhance the competitiveness of EU industries in supporting new jobs, growth and investment, by bringing to the market a range of new cost-effective, high-value technologies, products, processes and services.

2.5 Developing smart, connected territories and value chains in rural and coastal areas

Helping the rural and coastal areas to meet the wide range of economic, environmental and social challenges of the 21st century is one of the key challenges for Europe.

This orientation addresses the territorial dimension of R&I activities in primary production, the food and bio-based industries, most of which are located in rural and coastal areas.

Activities will allow for better capitalising on territorial assets (e.g. natural, physical, social, cultural), taking into account long-term drivers (demography, migration, ageing, gender, education, land-use dynamics etc.) to open new sustainable avenues for business, services and value chains in support of the diverse needs of rural and coastal communities. Activities will promote new partnerships between producers, processors, retailers and society. Land-sea-urban interactions will be further explored to boost economic activities in rural and coastal territories in sustainable ways. Information, knowledge and skills are essential in this process and activities will give particular attention to innovation systems and the human, environmental and social capital.

Activities will explore the potential of the 'digital revolution' to reduce the divide between urban, rural and coastal areas and create smart, connected territories and value chains. Digital technologies are producing large amounts of data, which when analysed and interlinked have the potential to create new knowledge and intelligent solutions to address societal needs. Information and Communication Technologies will be further developed to improve practices in primary production, the organisation of food and non-food industries, the quality, traceability and authenticity of products and services, and ultimately engage consumers and society in value chain processes.

Activities will also address the Blue Innovation Coastal Cities, including high level coastal zone protection and innovations to secure deep waters cultural heritage. The development and management of blue-green infrastructures will be given due attention.

In the short-medium term, SC2 R&I will unlock the potential of innovation to sustain and transform jobs and livelihoods in rural and coastal areas. Furthermore, in the long term, it will support the delivery of environmental, social and cultural services that extend to benefit cities and metropolitan regions.

3. Calls

The above described orientations will be made operational through the following calls.

Call Working Title	Description	Possible participation in-from other work programme parts
Sustainable Food Security (SFS)	Actions to tackle the environmental, economic and social dimensions of food and nutrition security in a comprehensive manner. Special attention will be given to climate and resource smart primary production and food value chains as well as to the ecosystems-food-health nexus.	Possible participation in the Virtual Focus Areas on: Climate Circular Economy Digitisation
Rural Renaissance (RUR)	Actions to address the territorial dimension of SC2 sectors with a focus on the development of non-food value chains (including from forests), biobased industries, digital technologies and the delivery of public goods in rural/coastal areas, seas and oceans.	Possible participation in the Virtual Focus Areas on: Climate Digitisation Circular Economy
Blue Growth - Harvesting the ocean opportunities	Actions to expand knowledge about the aquatic ecosystems, support sustainable, cross-sectorial innovations around the marine and maritime sectors, maintain healthy ecosystems, and strengthen international and regional cooperation around the blue economy and the future of the seas and oceans, in order to address climate change impact, resilience at sea and relevant SDGs, while maximising social and economic benefits.	Possible participation in the Virtual Focus Areas on: Climate Circular Economy Digitisation Possible participation from SC1, SC3, SC4, SC5, KET, Research infrastructures, LEIT ICT

[i] https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/AGRI_StrategyPaper_WEB_1.pdf

[ii] https://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf

Food value-chains account for some 30% of global GHG emissionsii – and the agricultural sector alone accounts for about 10% of Greenhouse Gas (GHG) emissionsii At the same time, forests, agricultural soils and aquatic ecosystems are at the centre of GHG mitigation efforts, with forests capable of storing more than 10% of the EU's GHG emissionsii. On the other side, oceans produce at least 50% of the oxygen, have absorbed 93% of extra heat between 1971 and 2010, and store around 30% of the excess carbon dioxide produced by humans, thus buffering the impact of global warming and mitigating its impact on the food system on land as well.

[iii] 90% of EU chemical industry feedstocks for non-energy material use come from fossil

[iv] Fish already represents 16% of all animal protein and 6.5% of all protein for human consumption, a proportion of the world's food likely to increase in the years to come.

[v] http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/lsa/131126.pdf

[vi] http://www.eip-agri.eu/

[vii] Industry 4.0 or the fourth industrial revolution, is the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things and cloud computing.

Circular Bioeconomy would see the traditional approaches to circular economy and bioeconomy integrated together, leading to more sustainable resource use.