Analysis of Horizon 2020 Societal Challenge 5 Strategic Programme Consultation Results

I- Participation

The public consultation was open between the 7th of May and the 23rd of June 2014, including one week extension of the original deadline. It was open in the Horizon 2020 website since the 14th of May, but some relevant stakeholders were directly invited to contribute through personalized e-mails. For example:

– Industrial organisations, including European Technology Platforms (ETPs),

– Financial organisations,

– Foundations,

– NGOs,

– Regional stakeholders.

The consultation was based on three background papers:

– Consultation paper: "Consultation of the Horizon 2020 Societal Challenge 5: Stakeholders providing advice on potential priorities for Research and Innovation in the Work Programme 2016-2017",

– First Report of the Horizon 2020 Advisory Group (AG) for Societal Challenge 5: 'Climate Action, Environment, Resource Efficiency and Raw Materials',

– H2020 Specific programme.

The consultation included a set of questions to stakeholders, but any suggestions were welcome:

Please consider the following questions, citing any available evidence such as foresight and other assessments of research and innovation trends and market opportunities:

1) What is the biggest challenge in the field concerned which requires immediate action under the next Work Programme? Which related innovation aspects could reach market deployment within 5-7 years?

2) What are the key assumptions underpinning the development of these areas (research & innovation, demand side and consumer behaviour, citizens' and civil society's concerns and expectations)?

3) What is the output that could be foreseen, what could the impact be, what would success look like, and what are the opportunities for international linkages?

4) Which are the bottlenecks in addressing these areas, and what are the inherent risks and uncertainties, and how could these be addressed?

5) Which gaps (science and technology, markets, policy) and potential game changers, including the role of the public sector in accelerating changes, need to be taken into account?

6) In which areas is the strongest potential to leverage the EU knowledge base for innovation and, in particular, ensure the participation of industry and SMEs? What is the best balance between bottom-up activities and support to key industrial roadmaps?

7) Which areas have the most potential to support integrated activities, in particular across the societal challenges and applying key enabling technologies in the societal challenges and vice versa; and cross-cutting activities such as social sciences and humanities, responsible research and innovation including gender aspects, and climate and sustainable development? Which types of interdisciplinary activities will be supported?

DG RTD – Directorate I received **139** contributions, **24** from individual respondents and **115** (almost 83%) from organisations.

Most individual respondents were affiliated with academic institutions, such as universities and research centres. Three worked for industry, including one employed by an SME.

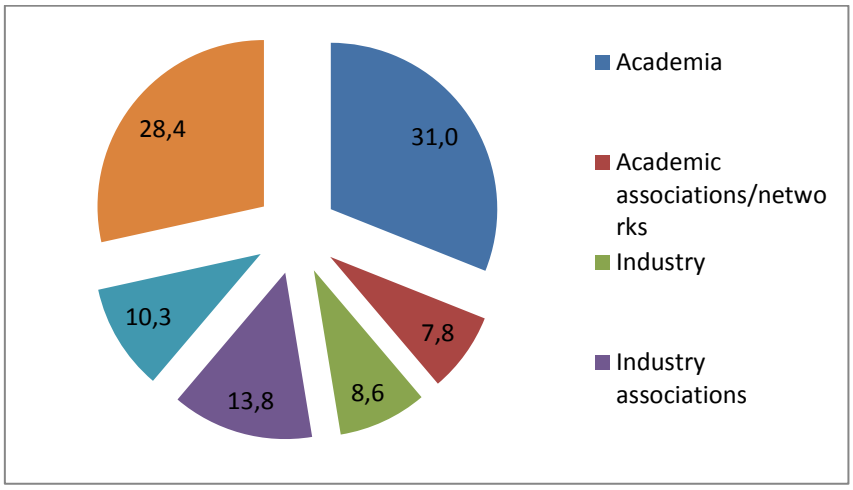
The breakdown of organisations that participated in the public consultation was dominated by academic institutions and associations. Industry and industry associations represented 22.4% of the answers, while other organisations such as JPIs; ERA-NETs and other European networks; regional and local authorities; national agencies; a standardisation body and several FP7 projects, accounted for 28.4%.The percentage of industrial respondents (single companies and industry associations) was higher than their participation in FP7 (Environment): 22.6% versus 19.5%. The participation of NGOs/CSOs (10.4%) was also proportionally higher than in FP7– Environment (3%).

Amongst industrial associations or networks, several European Technology Platforms contributed. There were also responses from their national equivalents, such as some national Construction Technology Platforms. The percentage of industrial respondents was higher than the private for profit participation to FP7 (22.4% vs. 19.5%).

Amongst financial organisations, only one responded to the consultation, however it was an authoritative stakeholder.

Figure 1 shows the breakdown of organisational contributors by nature of the organisation.

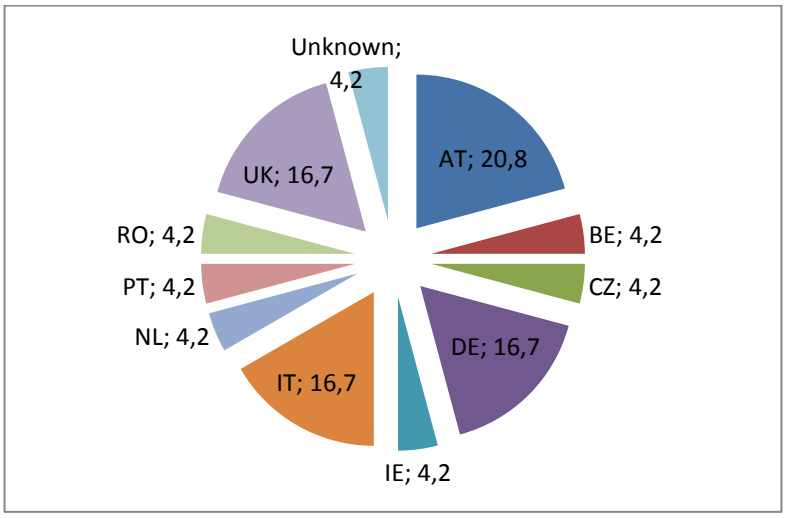
Figure 1: Breakdown of organisational contributors by nature of the organisation (%)



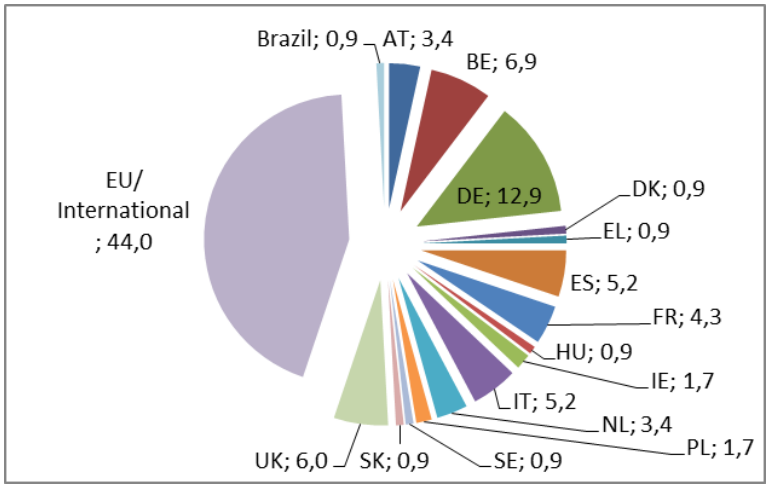
Most respondents came from European or international organisations (36.4%), followed by Germany and the UK. From outside Europe, there was a contribution from three Brazilian universities. Figure 2 shows the breakdown of contributions (individual, organisational and all together) by country.

Figure 2: Breakdown of responses by country (%)

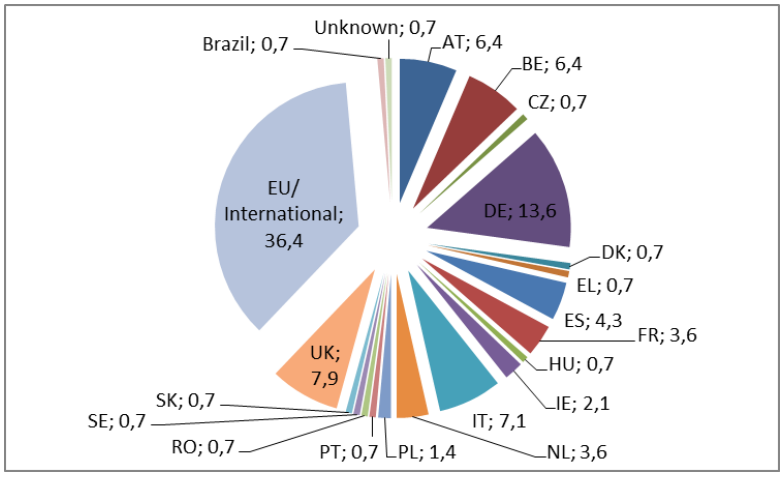
Individual respondents



Respondents from organisations



All (Individual + Organisational)



This document briefly summarises the main points raised by the participants to the public consultation, i.e. just a small proportion of all possible research and innovation (R&I) and environmental stakeholders. Readers need to be aware about the bias and caveats of the exercise, which does not pretend to be a representative survey amongst stakeholders. The report reflects the results of the consultation and does not represent the views of the European Commission or any of its services.

II- Synthesis of contributions

Although at the first glance the content of contributions looks fragmented, there is a general consensus about challenges and needs:

- **Interdisciplinarity** of R&I actions, in particular including social scientists in projects,
- **Holistic/Systemic approaches**, able to interconnect disciplines and communities,
- A need to improve **stakeholders participation and engagement**, connecting academia and industry (large companies and SMEs), but also local players, end users and citizens.

The **transition towards a circular economy/systemic eco-innovation** (the two terms were sometimes used with the same meaning) is an essential part of a vast majority of contributions, even if not always mentioned explicitly. There was a strong consensus around the necessity of changing **production and consumption patterns** towards a sustainable, green economy and society.

Fully aware of the difficulty of establishing such a new paradigm, a high number of stakeholders went beyond the R&I field. They proposed a **policy-mix**, including regulation, taxation, public procurement and **awareness-raising** measures. Stakeholders also stressed that social innovation was very much needed.

In general, respondents felt that society was not fully aware of environmental problems and potential adaptation and mitigation solutions. More sustainable technologies and lifestyles exist, but stakeholders saw their public acceptance as a critical bottleneck for mainstreaming. This is why several contributors proposed to implement **large scale pilot projects and demonstrations** ("living labs") to test, demonstrate and increase social awareness, while developing new markets. Such projects would provide quantitative information on the value of, for example, nature-based solutions and enhanced understanding of the multiple functions of ecosystems (e.g. food, water, energy, water catchment, climate change mitigation, tourism/economic benefit, spiritual value).

Several stakeholders also asked the Commission to implement **longer projects**, especially when Technological Readiness Levels (TRLs) are low. The Commission services were alerted that effective nature-based solutions might require long time scales (perhaps decades) for associated natural processes (e.g. elements of ecosystem restoration) to come into effect or provide the desired results.

How to implement this approach? – Specific R&I areas proposed

In line with this rationale, **cities and buildings** were seen as a key area for research and innovation. Cities were considered a major challenge (demographic issues, increasing urbanisation, pollution), but also a perfect experimentation field for greening day-to-day life, deployment of nature-based solutions, ecosystem-based management and eco-innovation activities like:

- Implementing nature-based solutions to address urban challenges (flooding, heat island effects, polluted air, etc.),
- Training architects and engineers to use resource efficient technologies and design,
- Developing "scenario simulations with appropriate models, which should deliver indices and values that characterize the future urban climate, heat stress, and air quality, as well as energy and water demand", useful for urban planners and local stakeholders,
- Strategies for sustainable re-use, assessment and renovation of historic buildings and monuments. For example, vernacular architecture[1] solutions could be implemented, using local traditional materials and techniques. This, on the one hand, could be an example of nature-based solution and, on the other hand, could contextualise constructions and preserve the cultural heritage,
- Exploiting catastrophic events data and model to design adapted buildings,
- Use of renewable resources in the production of building materials,
- Development of "urban mining", understood as "recycling of metals and raw materials from waste of electrical and electronic equipment stocked in house buildings",
- Social innovation, through bottom-up initiatives empowering of citizens like urban farming, energy self-production, individualized energy/environment impact assessment tools, or even collaborative/participatory urban planning and management.

A number of contributions related to cities concerned more clearly other Societal Challenges, e.g. Energy. For example, implementation of "Zero Energy Districts", large scale deployment of cloud computing related to real energy consumption in residential buildings ("big data"), implementation of smart grid and smart buildings, etc.

Suggestions concerning cities and construction were particularly interesting, because they combined development and deployment of technologies, social innovation and a vision about what living in urban places should look like in the future. The suggested change of lifestyles paradigm was perfectly illustrated by the contributions.

Consistently with changing lifestyle paradigms, several stakeholders mentioned the need to investigate (and disseminate) the **links between environment/climate change, food, energy and health/wellbeing**. Suggestions also included a socio-economic dimension, addressing issues such as how to deploy in the coming years sustainable food products and services and how to achieve more sustainable and healthy levels of resource consumption while maintaining human well-being.

There were several economic considerations about the economic potential for industries like the pharmaceutical or the medical sector, but those respondents did not develop their reflexions further. Moreover, some stakeholders made some concrete, purely scientific, proposals, e.g. on toxicology and exposure assessment.

The need to support research and innovation activities in the field of **systemic eco-innovation/circular economy** appeared as particularly relevant to tackle the resource scarcity issue. The set-up of a cooperation and collaboration process among all societal stakeholders, together with the development of new business models and new production and consumption patterns, emerged as key objectives for R&I efforts and investments in this field. EU support

[1] architecture based on local needs, materials and traditions

for systemic eco-innovation was expected to generate job and growth opportunities and to reinforce Europe's global leadership in the field of green economy.

The *use of ICT for implementing and monitoring the circular economy* was considered key. For example, ICT allows a sustainable land and forest use and management. Examples of potential innovations and visions to achieve a sustainable and productive agriculture, were provided:

- advanced precision farming tools and techniques could be developed and offered, combining advanced geo-localisation and meteorological services;
- a specialized logistic for the fresh and super fresh food products, that could be developed based on Galileo services to ensure the delivery of the products in 24 – 36 hours from harvesting. Such an achievement would also open the way for the agricultural products to be negotiated as futures on a dedicated European stock exchange.

The sustainable land and forest management does not prevent for *reusing and recycling post-consumer wood materials*. This was considered a particularly complex challenge; which would require significant R&I actions within the coming 5-7 years. Stakeholders considered that currently the supply of biomass was far from secure, due to divergent interests between industries and forest owners, large variation in ownership categories and structure, as well as market mechanisms.

Eco-design was also seen by several stakeholders as a critical element to make eco-innovative products attractive and re-usable.

Several respondents stressed that *purely scientific areas/topics* which produced basic knowledge to move towards systemic eco-innovation, like the environmental impacts of shale gas, should be considered.

Furthermore, contributors referred to the need to include the protection of cultural heritage among the key challenges of the EU sustainability strategy. According to respondents, cultural heritage is a strategic, non-renewable resource creating enhanced social capital, as well as economic impact in achieving the Europe 2020 strategy goals. Reference to the cross cutting nature of cultural heritage and culture, as well as to the need for the valorisation of cultural heritage was also made.

An example of cross-cutting action is a link between climate change and cultural heritage. Cultural heritage was seen as an area where climate change services should be exploited. Stakeholders considered that there was a need for methods and technologies to contribute to preventive conservation strategies of moveable and immoveable cultural heritage assets in a context of changing climate and environmental pollution, including a better management of catastrophic events.

In parallel to these cross-cutting areas, a high number of contributions focused on more sectoral fields, like water, raw materials, CO2 emissions or climate change research and services. A number of contributors welcomed the recommendations made by the Advisory Group, and more specifically climate change services and nature-based solutions.

Water was a predominant topic in the consultation. The logic behind the contributions in this area consisted of moving from wastewater treatment to resource recovery; in particular, recovering energy, carbon compounds, nutrients (phosphorus, nitrogen, potassium, magnesium) and, of course, water.

Several stakeholders explained that used water has an enormous potential for recycling. For instance, Europe imports 92% of its needs in phosphates, while part of them could be recycled

from used water. Respondents underlined that a forward-looking rethinking of water treatment was required, as well as large scale demonstration activities. By mainstreaming this new approach, Europe could develop a competitive advantage and transfer its know-how.

Amongst the technologies and/or innovations that were necessary for water management, contributors mention membranes, biotechnology processes, methods of measurement for chemical and microbiological risk markers, real time online sensors in water quality monitoring or cost-efficient desalinization techniques. They also mention the need of developing industrial symbiosis for water and a better use of rainwater.

Raw materials[2] recycling and efficient use appeared in several contributions, at least indirectly (e.g. resource recovery in used water). The challenge of European dependency on raw materials imports was often raised. Two contributors, including a major industrial stakeholder, mentioned mining. They proposed to explore effective and environmentally friendly exploration methods which would reduce the environmental and societal impacts of mining activities for operating as well as for abandoned mines. According to them, the main barrier was public acceptance, which implied the need to work with different stakeholders.

CO2 capture, storage and exploitation was presented by a number of respondents as another major challenge. The notion of circular economy appeared again; and contributors mentioned different possible uses in sectors such as agriculture or chemistry. The need for large scale demonstrations was also raised.

However, some contributors alerted us about the risk of focusing too much on CO2 and not enough on other **air pollutants** that are also have negative effects on environment, and create risks for the whole economy (e.g. for crops). Emphasis was put on considering air pollution and climate change together.

Climate change research and development of services were often mentioned in stakeholder contributions. According to respondents, one key issue in this field consisted of improving climate information/projections at regional level and the capacity to provide "regional perspectives" of changes, risks and impacts at timescales (seasonal to inter-annual to decadal) that were relevant for decisions to businesses, industry and local authorities.

Climate change services were understood in a broad sense, including climate change-related forecast and risk vulnerability assessment (not forgetting less risks that are currently less understood, such as those related to water stewardship, forest commodities or supply chain resilience). It was also noted that research on *high-resolution regional modelling* was essential in order to improve our capacity to assess impacts and risks.

To develop a climate change services market, there is a need to strengthen the *provider-user interface*. Currently there is only limited consideration of the products needed by the users. It is also necessary to create appropriate "communities of practices" and emphasise the co-design of climate services products. Overall, appropriate involvement of stakeholders that would allow to identify user needs, develop user capacity and improve exploitation capabilities was highlighted as a key element.

The predominant vision in the public consultation focused on development of *public-private climate services marke*t. It should be based on *free and open basic services*. Building on this, SMEs and other businesses would provide fee-based highly customised climate services for specific needs/customers.

[2] This part on raw materials is developed with less detail, due to the fact that a European Innovation Partnership on raw materials is an already existing specific and efficient communication channel for stakeholders in this field.

Stakeholders recommended to maintain and expand observation and monitoring systems. New observation systems that take advantage of new technologies and trends, targeting both global (e.g. nutrient cycles, carbon budgets, land-use, water) but also local information/parameters, are key to foster the establishments of a market for climate services. Both space and in-situ measurements should be considered.

More specifically, contributors mentioned the need to finance climate change-related research in specific fields such as:

- Paleo-climate research, especially in Polar areas, through the analysis of ice,
- A need for better knowledge of subsurface. This requires coordination and standardisation actions, since the current knowledge is fragmented between countries,
- Better coordination of Earth Observation systems to understand and monitor how ecosystems are responding to climate change,
- Establishment of a global climate change and environment observing system, with storage of data, in collaboration with the World Meteorological Organization,
- Climate change in extreme conditions, like Amazonia or the tropics,
- Climate change and its ecological and socio-economic consequences in mountain areas,
- Continental Shelf Prehistoric Research, a new trans-disciplinary domain linking the analysis of climate/ sea level change, environmental conditions and the prehistoric archaeology of people who lived and migrated on the ancient coastal plains,
- (Extreme) climate change as a factor influencing migration.

Last but not least, the importance of some other specific areas of R&I action was highlighted to the Commission:

– Implementation and cost-efficient mainstreaming of the *European environmental footprinting methodology for organisations and products*, actionable for all types of companies (both multinationals and SMEs). This environmental traceability of products and raw materials would increase environmental awareness and empowerment of consumers,

– *Recycling of inorganic, non-metallic waste* coming from tunnel excavation material, construction and demolition and residuals of metallurgical and combustion processes. This is already the largest waste stream in Europe which, according to the respondents, is not considered in waste legislation,

– *Paludiculture*, i.e. the wet cultivation of marshland, either in traditional processes of peatland cultivation (reed mowing, litter usage), either through new processes like the energetic utilisation of biomass of the marshes,

– *Green infrastructure*: research to support large-scale restoration of degraded terrestrial, freshwater and marine ecosystems and implementation of green infrastructure,

– Development of *sustainable logistics*, not neglecting innovation in alternative transport modes like inland navigation.

III- Conclusions – some key messages

Respondents welcomed the opportunity to contribute to this strategic programming consultation.

Despite the diversity of the contributions received in this public consultation, there was a clear consensus about the need to implement systemic and interdisciplinary solution – oriented approaches, with a participation and engagement of stakeholder (i.e. industry, local authorities, final users, CSOs, citizens).

The focus was not only on novel ideas or fields of R&I, but strongly on innovation and implementation of technology, including issues such as how to exploit existing technologies and/or mainstreaming more sustainable social innovations. Awareness-raising was mentioned as critical to change consumption and production patterns. This explained the emphasis that respondents had put on large scale pilot actions, especially in cities. They would demonstrate to authorities and citizens that other more sustainable lifestyles are possible without losing well-being.

The idea of well-being was very present in the contributions. Respondents focused not only on creating scientific knowledge or economic value, but also on increasing quality of life in a better environment. One of the most frequently mentioned topics was the link between environment/climate change, food, energy and health.

The concept of circular economy framed most contributions (e.g. water, raw materials, CO2). However, an industrial stakeholder alerted us about the fact that this idea required valorisation of discarded products in a marketable manner. This requires, for instance, adequate skills to find solutions that are reliable technically, sustainable and competitive in the market.

A high number of respondents considered that there was an innovation potential in specific proposals, but market logics were generally absent. Therefore, further involvement of industry and final users in projects could increase the impact of R&I actions.

It should also be noted that the respondents often explicitly appreciated the report of the Advisory Group, which helped to structure their responses. This document launched a reflexion and debate. It was commented and discussed by a number of respondents.