ETP Secretariat
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Stakeholder consultation on SC5 – Climate action, environment, resource efficiency and raw materials

ETP 'Food for Life' contributions

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?**

It is our opinion that higher focus on the 'food security under climate change' should be envisaged under societal challenge 5.

Food security relates to the availability of and access to sufficient food and healthy diets and good nutrition at all times which is central for the wellbeing of people and nations. Until recently, it was expected that despite climate change and increasing world population, there would be several decades with food surplus - and low prices - ahead. However, this thought couldn't be more far from the reality; climate change is already negatively impacting food production. In a society where the demand for food, feed, fuel and fibre are increasing, the global environment is changing and is moreover constrained by planetary boundaries such as land and water limits, the sustainable increase of food supply to accommodate a world growing to 9 billion or more people by 2050 while preserving a safe operating space for humanity by avoiding dangerous environmental change become a key and complex challenge.

In this context it is for us very important to increase the links between agriculture, food production and climate change and promote an innovative bio-economy to support the "green growth" strategy that would combine economic growth, natural resource preservation, highly efficient resource utilisation in well integrated value chains and greenhouse gas reduction.

Climate Action - Sustainable food security under climate change

<u>Climate change risk assessment for European agriculture in a global context: What are the risks and the opportunities for European food security and agriculture?</u>

All food industry is dependent on reliable and efficient production of raw materials, and sustainability of food supply systems needs to include also primary production as agriculture,

Avenue des Nerviens, 9-31 - 1040 Brussels - BELGIUM - Tel. +32 2 514 11 11 - Fax. +32 2 511 29 05
info@fooddrinkeurope.eu - www.fooddrinkeurope.eu

aquaculture and fisheries. Globally, water scarcity is also a critical issue, even though the regional variations are large. Moreover, in a future facing climate changes, it is clearly predicted that water availability will be even more limited, especially in already water stressed areas.

To adapt and mitigate climate change impact and ensure future sufficient safe food supply it is first of all important to understand how climate change will modify the current production patterns and then develop new sustainable sources, new raw materials, new production systems and techniques, re-use of waste, and new product concepts to overcome scarcity stress. In this context, food innovation (products, processes, systems, social innovation) that enhance productivity/efficiency are required to make the entire bio economy viable, by freeing resources (land etc.) for other uses that in turn can contribute to energy production and products from biological sources. It is however important to highlight that energy should never compete with food. To guarantee the success of such innovation and improve production systems under stress it is also important to study the impact of resource limitations on production. Another aspect that might be taken into consideration is the appearance of emerging and re-emerging pathogen due to climate changes, although changes in agricultural practices remain the main drivers for the emergence of zoonotic pathogens, the possible consequences of global warming should be also explored.

Consequences of changes in food systems (including food habits, processing, wastes, consumption...) on climate change (GHG, footprints, etc.) and, conversely, climate change impacts on European food systems.

It is very likely that an efficient way of increasing the environmental sustainability in European food systems is changing consumption patterns, away from resource demanding products towards less demanding. This will also have large long term implications for global food security and hence to global equity and social stability. Diet changes will however have repercussions on social and economic aspects in the food sector, both within the EU and globally. Large scale diet shifts will also affect the environmental sustainability of agriculture, e.g. reduced meat consumption will affect crop rotations and plant nutrient flows as well as need for plant protection. Diet changes are extremely difficult to implement, for a number of reasons, and research is needed to understand the processes behind such changes. Therefore, it is important to know how to quantify the impacts of large scale diet shifts, since such shifts will inevitably have large impacts on how food chains are built up and managed. There is a need for social and natural sciences as well as economics to answer these pressing questions.

Parallel to that research to support policy development towards effective regulation that impacts on consumer choices and behavior should be developed.

Environment, resource efficiency and raw materials

High-quality and well performing plant varieties are necessary prerequisites for the sustainable production of food raw materials and should also be analyzed in the light of climate change. Improving raw materials safety and traceability are becoming issues of major consumer concern. Research is needed to develop varieties that are more resistant to pests and diseases and new plant derived products that can replace parts of the animal products in the diet with lower dependence on feed imports and more sustainable high quality food supply systems. In addition new plant raw materials tailored to the specific health needs of individual consumers leading to new nutritionally enhanced food products which would be an asset to improve the quality of life of European citizens and Europe's competitiveness.

In addition developing sustainable food processing, preservation, packaging and logistic systems can have a huge beneficial impact on environmental protection and resource efficiency.

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)?**

There is a need to increase the effective use of modeling and standardised scenarios to better understand the effects of consumer behaviour on the food chain and decision making, and feedback loops. A more integrated approach examining life cycle analysis and diet is needed, looking at complementarity between foods, food nutrition and environmental consequences of food consumption. As consumers' choices and behaviour have an important impact in all the steps of the food chain, it is crucial to develop methods to quantify such impact, as changes in the consumer habits may have market repercussions (e.g. changes in food demand and availability), and to improve the access to information to allow consumers to make informed choices and to understand their impact. This can only be accomplished through integrated socio-economic approaches. In this regard, the development of effective regulation (research on this is needed) should play an important role.

As there are strong links between local, regional and global food markets, the regionalised impacts of climate change on land use and primary production will have unprecedented effects on global supply/demand. In order to establish control measures, further research on food market price volatility and its relation with climate change is needed.

Impact assessment of policy instruments and regulatory measures. Research on how development and evaluation of policy instruments takes place, and how to improve ex-ante impact assessment on various scales is highly recommended. Also, an appropriate regulatory framework is critical to face the challenges derived from climate change. There is a need to guard against regulation stifling innovative technological options that would improve food security under climate change.

Reduction of food waste alone will not solve global food security, neither will it make increase of primary production superfluous, but discarding less is a quick win that will alleviate the problem instantly. However, empirical data of the impact is lacking. A good assessment requires looking at food losses in different parts of the food chain (farm level, post-harvest level, transport, processing,

markets and consumers). In this regard, the situation in developed countries differs greatly from those of developing countries.

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?

To outputs of the research needs identified in question 1 are:

i. Provide new approaches for the sustainable growth and intensification of agriculture in Europe including transformational adaptation and increase the resilience of food systems to deliver European food security, feed, fuel, fibre as well as other ecosystem services under current and future climate and resource availability;
ii. Provide the foundation for novel and sustainably produced foods with unique sensory and convenience qualities, hence strengthening the competitiveness of the European food sector.
iii. Provide an integrated impact assessment of climate change throughout the whole food chain, including market repercussions;
iv. Contribute to direct reductions of greenhouse gas (GHG) emissions through carbon sequestration, fossil fuel energy substitution and mitigation of N2O and CH4 emissions by the agriculture and forestry sector, while reducing GHG emissions per unit area and per unit product associated with land use change;
v. Sharply reduce trade-offs between food production and the preservation of biodiversity, ecosystem functions and services.

Climate change, environment, resource efficiency and raw materials are above all global challenges and therefore there are several opportunities for international linkage. For instance, the primary production of the ingredients for the European food industry is not only based in Europe but is a worldwide issue e.g. >30% of global oil & fats are palm oil based, which can only be grown in the tropics, while vegetable protein and animal feed, so essential for the European dairy/meat industry, relies heavily on South American soya. Consequently, non-European partners will be essential in future sustainability research.

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

There are many knowledge gaps to be addressed in these areas. The areas are common to questions 4 to 7 of this consultation, although areas will be identified as having greater or lesser potential as we address each question. The areas and their sub-sections are:-

- Material efficiency from farm to fork – reduced waste and increased utilization of by-products

- Optimisation and reduction of food waste in a food chain perspective
- Development of biodegradable packaging materials made of food waste or other raw materials that does not compete with food production
- Assessments of the drivers of food chain waste, economical, technological and social.
- Management instruments to ensure sustainable food losses and waste in food chains

- Production systems for alternative protein sources
  - Protein sources: novel plant proteins from crops such as soy and lupine
  - Insects such as locusts and mealworms
  - Marine sources such as algae and seaweed
  - Blue biotechnology
  - Consumer acceptance and use of alternative protein sources:
  - Heath aspects
- Developing sustainable processing, preservation, packaging and logistic systems
  - Non-thermal processes (use micro/macro nutrients, bioactive compounds etc.)
  - Small scale processing with high performance
  - Energy- and water efficient processes
  - Waste minimisation, “management of clean flow” (avoid mixing and contamination of side streams)
  - Packaging design to improve sustainability; easy to empty, environmentally friendly materials, design for recycling, design to increase efficiency in logistics/storage etc.
  - Biodegradable packaging materials made of food waste or other raw materials that does not compete with food production.
  - Interdisciplinary research on water (environmental aspects of water use in food processing, water processing/cleaning and management)
  - Re-evaluation of existing processes in terms of sustainability
  - Alternative drying to avoid phase transition processes, e.g. osmotic drying to remove water and avoid phase transition.
  - Transformation of waste into products for a different sector.
  - Traditional foods as a tool for functional foods production: The market share of traditional fermented foods in Europe (20% of Europe’s food business with an annual turnover of €800 billion) is growing, as consumers have an increasing awareness for artisan handling, gastronomic quality, and healthy food status. The existence of many SMEs, typical producers of those foods, is threatened because of loss of traditional know-how and severe market pressure deriving from increasing industrial globalisation of multinational food companies.
- Understanding consumers and their behavior regarding sustainable food consumption
  - Research on synergies and conflicts between changed consumption patterns, including environmental, social and economic aspects.
  - Research on trends on social innovation connected to shorten circuit from farm to consumers, as regional foods.
- Development of new tools and methods for assessing and analyzing sustainable food systems
  - Reinterpret the sustainability concepts to indicate solutions for the current and emerging food issues.

- Find out new useable tools for measuring sustainability. New measuring tools should be: a) Simple/cheap, b) Acceptable, c) Trustable and d) Enforceable
- Develop specific instruments for the sustainability assessment of new technologies.

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?

While all of the topics outlined in 4 above need to be addressed as a matter of urgency, they need to be addressed not only by relevant teams of interdisciplinary researchers but must also be addressed simultaneously by public policy makers since policy changes will be driving behavioural change just as much as will technology developments. For example, there must be financial incentives not only for the development and use of alternative technologies and nutrient sources since the consumer will need education and persuasion before accepting such changes. Consequently, while there may be a temptation to expend public resources in technology and nutrient advancement, they will not have the desired success unless it is matched by increased understanding of consumers, consumer choice and ongoing developments in dietary change and consumption habits.

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?

The European food industry consists of in excess of 400,000 companies, 98% of them in the SME category and a large fraction of these in the 'micro' company range. While size is not necessarily an impediment to adoption of innovation, a major barrier is the lack of scientific expertise in many of these micro-sized and family-run enterprises. Since turnover and costs are major drivers in the sector, it is likely that innovations that lead to cost reduction, new product production and increased competitiveness will be implemented more readily than innovations driven by sociological and environmental concerns. Consequently, the two areas in 4, above, that would ensure SME participation will likely be:-

- Production systems for alternative protein sources, and
- Developing sustainable processing, preservation, packaging and logistic systems

Together with many of their industry oriented sub-sections. This ETP have gone to great lengths to ensure that the needs of SMEs are addressed in its Strategic Research and Innovation Agenda. It is clear when discussing their needs that what is required is access to appropriate low-cost technologies, access to new raw materials, access to finance and a regulatory environment that is conducive to rapid innovation while not ignoring food safety.

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?**

There is no doubt that any significant innovation will only be delivered by large multi-disciplinary teams that incorporate not only technology experts but also nutrition experts and agronomists to deliver the new raw materials, appropriate social scientists, including consumer scientists that will deliver an integrated solution where technology developments are more likely to be accepted by the consumer as a result of better understanding of what influences consumer decisions and choices and, equally importantly, what technological developments are likely to induce unnecessary fears and doubts in the consumer mind. No food product or process, no matter how scientifically brilliant will succeed if it remains on the supermarket shelf. Consequently, only teams that develop the information that will ensure technological excellence but also the means of ensuring successful marketing of the idea will generate the innovation that society not only desires but needs in the coming years.