Brussels, 26 June 2014

STAKEHOLDERS' CONSULTATION 2014

HORIZON 2020 SOCIETAL CHALLENGE 2

Food Security, Sustainable Agriculture, Marine, Maritime and Inland Water Research

and the Bioeconomy

Please consider the following questions, referring specifically to the Horizon 2020 Specific Programme for Societal Challenge 2 'Food Security, Sustainable Agriculture, Marine, Maritime and Inland Water Research and the Bioeconomy'[1].

Please quote where relevant any available evidence such as foresight and other assessments of research and innovation trends and market opportunities.

Replies to each question should be limited to 815 words.

Thank you for your kind collaboration

Identifying the challenges

1) In the framework of the Horizon 2020 Societal Challenge 2, what are the most important specific challenges which require immediate actions in order to achieve smart, sustainable and inclusive growth?

It is our opinion that a higher focus on the 'food processing, packaging, safety and food chain management' to ensure innovation within food SMEs should be envisaged under societal challenge 2. Developing new food processing, preservation, packaging and logistic systems can have a huge beneficial impact on environmental sustainability, food security, healthier diets and resource efficiency. It will reduce our dependence on food imports and will help to restore the percentage of the global food economy held by the European food industry, a percentage that has been declining slowly in recent years.

Our aim in developing this challenge were firstly to define processes and packaging for management of the food structure life cycle to obtain high quality products with new and improved properties

[1]Pages 54-59 of http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0811:FIN:en:PDF

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(aimed at PAN-achieving preference, acceptance and fulfilling needs) related functionality, aimed at aspects of three other challenges, namely

a) Improved Health, Well Being and Longevity ("Life to years"),
b) Consumer Trust in the Food Chain, and
c) Sustainability.

A second aim was to describe what the physiological impact of changes in food structure is, in the context of the process-structure-functional property relationships in order to prevent deleterious changes, which negatively affect product quality, nutrient bioavailability and functionality.

This should:
1) Generate information leading to an EU Food Industry capable of achieving

- optimum sustainability,
- optimum efficiency (on economic, technological and ecological levels)
- extended delivery of food products with new properties and functionality aimed at fulfilling preference, acceptance and needs of consumers (by reverse engineering approach).

2) Ensure greater integration in research between processing, food quality and safety, nutrition/health and sustainability. This could be achieved by making it mandatory for research programmes to foster collaboration between disciplines, particularly in large research programs like Marie Cure schemes, therefore bringing together scientists such as nutritionists, clinicians, environmental and/or consumer specialists with technologists and process engineers. The topics should be integrative for a trans-disciplinary approach, not the sum-total of interests of the participating disciplines. The logic should follow processing creating/transforming structure and structure determining properties to be specifically categorized within nutritional/health supporting and environmental food standards. Such pioneering work should finally also support standardization by the WHO/FAO - Codex Alimentarius.

3) Update training of food science/-engineering students, in order to avoid exclusive specialization, and enable the initiation of research across the borders of scientific disciplines. This should in particular involve the integration of knowledge from disciplines, such as nutrition, medicine and physiology, pharmaceutical and cosmetics technology as well as material science, health science and resource economics.

4) Strengthen an SME innovation platform. - Innovation is not just about new ideas, but how to use and combine process and material aspects in new ways. Innovation efficiency by SMEs can be improved based on infrastructural improvements reducing "time to market". Often there is a gap between researchers developing new technologies and SMEs that must be more efficiently bridged. In some cases, innovation by SMEs is low and infrastructural improvements are necessary, as SMEs do not have the capacity to take up new technologies from the research. In other cases, the situation is exactly the opposite, and an example of this is the very successful model in Switzerland, referred to

as the 'CTI projects'. These are open for SMEs, universities and start-ups where the government pays the half and the participating large companies the other half. The IP is for the small company which should be strengthened. The win-win for the larger ones is that certain processes, methods and new science & technology, which will not find in-house investment and support, can be developed by universities and SMEs which will bring the results to market. It builds on the creative strengths of SMEs and universities in quite a practical sense.

Transformation of research outcome into practical applications are a major challenge. It is important to properly link R & D policy with consumer protection policy.

For example novelty aspects require premarket approvals, to assure that food safety aspects are properly assessed. The outcome of these processes are rather uncertain since the outcome of both the risk assessment process followed by the risk management measure is not immediately predictable. Intellectual property right are of major concern here.

2) What key research and innovation areas need to be addressed in order to tackle these specific challenges, and meet the specific objectives of Societal Challenge 2?

A number of areas can be identified for research action:-

Processing, preservation and packaging: This is based on recognition of the contribution of food structure and function, arising from food processing and packaging, to nutrient bioavailability and impact on host physiology, thus appreciating that food processing does not stop when the food is manufactured, or indeed when it is placed in the mouth, given the role of food structure and functionality to the performance of the food in the gut. Changes in food structure, texture, composition and quality continue in the food product following manufacture, during storage, meal preparation, following consumption as well as during digestion (gastro-intestinal processing), and furthermore, are impacted on and monitored by the types of food packaging technologies used. The concept of farm to fork is too limited, and needs to be expanded to that of from farm through digestion.

Healthier diets: 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.

Food and the Consumer: The ETP *Food for Life is convinced of the need for* research which link thorough and theoretically grounded understanding of consumer behaviors related to food choice with concrete and actionable policy relevant to product development (for example, integrating consumer preferences into the design of novel foods, balanced diets and active lifestyles), chain

innovation (improving the sustainability of food production systems in line with consumer preferences) and policy innovation (developing interventions designed to improve consumer health and quality of life). In other words, the "innovation trajectory" associated with novel foods development needs to integrate technological possibilities with consumer and policy priorities if societal and market acceptance of novel products is to occur.

The food safety challenge: One of the non-negotiables for Europe is the necessity for a safe food supply; it is an imperative for health, social, and economic reasons. While the food produced and consumed in Europe is now considered safer than ever, there are still several critical gaps in our knowledge of food safety and contaminants that limit our ability to prevent, predict and respond to food safety incidents.

Public food safety crises create a high degree of concern among consumers, and cause huge economic losses. A case in point is the 2011 European outbreak of a new variant of pathogenic E. coli that claimed thousands of cases of disease and several lives in Germany and in other countries. Another recent example concerns the melamine contamination of milk and powdered infant formula from China that impacted on infant health and worldwide food chains. Both incidents have seriously undermined confidence in the food industry. In addition to this there are other, more emotionally or politically influenced issues such as GMOs, hormones and some additives that influenced consumer confidence in a negative way. Consumer perception has evolved to a high level of awareness and a much reduced certainty, a combination which has led to this generalised lack of confidence. Indeed, this increasing concern about 'chemicals in food' has led to what is now described as 'chemophobia' in the public psyche. Coupled with a misunderstanding of 'hazard' and 'risk' there is clear evidence of the public's 'risk of risk perception' leading to rejection of perfectly safe foods and hence inhibiting innovation.

Some concrete areas which should be addressed:

- High quality stable and fresh foods, ready to eat, with ingredients, structure, and packaging extending shelf life and reducing waste
- The food-human axis: effect of ingredients, processing and way of consumption on food safety and human wellbeing, unlocking new mechanisms for adding functionality and value to existing and new food products
- Innovative technology solutions for the Food Factory of the Future
- Innovation supporting knowledge transfer tools & networks to SMEs
- Resource efficiency in food processing
- Systems against food frauds, promoting food safety, food integrity, and sustainable transportation and logistics
- Re-evaluation of conventional technologies for sustainability and waste reduction

3) 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)?

The key assumption is that for successful development of an innovative European food industry, it is essential that we combine process, packaging and product development research with consumer preferences, changing lifestyles, changing diets, and, of course, an over-riding safety ethic. Ignoring or failing to develop any of these key areas will result in underperformance and in development of products and processes that may not stand the test of a highly competitive market. Consequently, we recommend that funding calls not be confined to one area but rather should encourage the development of multidisciplinary programmes spanning these sectors. Society demands healthier and more nutritious products, produced in a safe and sustainable manner and that enjoy the confidence and acceptance of the consumer.

Tackling bottlenecks & gaps

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

There are currently several bottlenecks. The primary one is a shortage of the multidisciplinary teams that can successfully address these challenges. A second difficulty is the lack of understanding of each others disciplines and possibilities that may exist between the physical and the human sciences. It is probable that such teams will not be found in single institutions. However, the EU funding mechanisms have always facilitated the building of such multidisciplinary teams across institutions. Horizon 2020 should continue to encourage this.

SME involvement will continue to be a bottleneck in these activities. Since 98% of the 400,000+ companies in the European food industry are SMEs and the majority of these could be classified as micro-companies, ensuring their involvement will continue to be the hurdle identified in previous Framework programmes. New and innovative ways of involving them should be sought. In particular, some mechanism whereby they need not be involved in the early stages of a project but can be integrated into the research in the later stages when it becomes more applied.

5) Is there evidence for any major gap (knowledge, science and technology, markets, policies, competences, skills)?

There are major gaps in knowledge, science and technology. These are summarized below and can be found in greater detail within the Strategic Research and Innovation Agenda of the ETP: http://etp.fooddrinkeurope.eu/documents/2012/SRIA_2012/SRIA_ETP_Food4Life_2012.pdf

PROCESSING and PACKAGING

Food structure and the PAN concept (Preference, Acceptance, Needs of consumers) e.g. Design of new properties of foods, based on processing, aligned to consumer-relevant PAN profiles

Processing for functionality and nutrient security e.g. Integration in research between processing, food quality and safety and nutrition/health; technology developments to "preserve" the highest amount of essential nutrients by simultaneously achieving food safety

Modelling and ICT for improved processing and quality e.g. Next generation modelling, taking into account the whole chain in multiphasic properties of food components

Packaging innovation e.g. holistic approach to develop sustainable food packaging solutions by integrating the whole food chain processing

Sustainable processing e.g. Broaden the raw material base and increase biodiversity in order to derive plant based-new technologies which may allow for the exploitation of raw materials not currently used

Small scale processing e.g. Re-engineering by rescaling of existing processes; Point-of-use processing; Processing for SMEs

Processing for SMEs and use of technologies from other sectors e.g. Exploiting the available technical solutions from the manufacturing and ICT sectors for the food Factory of the Future; Processing solutions for SMEs

FOOD and CONSUMERS

Societal challenges, including food safety and security, health and sustainability e.g. Food safety and security; Trust, confidence and governance; authenticity; food related diseases; acceptance of reformulated foods; Ageing; Animal welfare; Protein supply

Behavioural changes, related to consumer decision making (including out-of-home eating and the consumer groups to be addressed) e.g. Consumer decision-making; Out-of-home consumption; Meal patterns and eating habits;

New Developments, relating to consumer engagement and price (sensitivity) e.g. The role of social media; Engaging consumers; Consumer response to price;

Methodological innovations, relating to disciplinary integration, longitudinal approaches and EU wide standard and tools e.g. Networking the consumer science capability; integrating disciplines and databases; EU standards in consumer science; Longitudinal analysis;

Dissemination, for SME applications e.g. Consumer science and SMEs;

FOOD SAFETY

Microbiological hazards and challenges e.g. While much is known about microbiological growth , microorganisms are moving targets. New variants emerge from mutation and adaptation, and long-forgotten microorganisms re-emerge. The interaction in ecosystems is complex. A number of knowledge gaps should be given attention within the next decade.

Chemical hazards including toxins of biological origin e.g. Human exposure to PFCs through food consumption; Toxicological effect of arsenic species on humans; Plant protection products, veterinary pharmaceuticals

Robust and cost-effective Risk Analysis (RA) concepts based on sound, cutting-edge scientific understanding e.g. Quantitative risk assessment is the knowledge base for building a food safety strategy. The tools being developed within this area (including predictive modelling) are important competitive instruments that underpin innovation in the development of novel products

Real-time & rapid detection tools to ensure safety and security of the food chain, including food defence e.g. to further improve the safety of competitive foods in the market place by developing and making available tools for prevention and control of specific hazards, traceability, authenticity and food defence

Defining opportunities

6) What are the emerging opportunities for advances in the areas tackled by Societal Challenge 2, taking into account the EU position in research and innovation?

While emerging opportunities exist in all of the areas outlined under 5 (above), some specific details are highlighted below:-

- Reduction of energy consumption - use of more efficient technologies
- Hygienic cutting with beams such as ultrasonic cutting.
- Sensor technology for the food sector for real time ad line/on line measurement
- Robotics adapting to the hygienic standards and biological variability in food production
- Vision systems for the food sector
- Smart green house management systems
- Mathematical modelling for prediction of food process management
- Cloud computing and wireless management systems
- Safe waterless disinfection systems
- Novel membrane techniques
- Nanotechnology for improving cleaning efficiency
- Novel, biodegradable and intelligent packaging materials

7) In which areas is the strongest potential to leverage innovation and, in particular, ensure the participation of industry including SMEs?

While all of the areas outlined in 5 and 6 above have potential for SME innovation, the following areas are highlighted as being of most immediate impact:-

- Developing modern information and communication technologies to provide real-time, rapid food safety information to the industry to support informed food-safety decisions and on-line process control for hygiene.

- Promoting a broad range of nano science and technology initiatives.
- Developing a fuller understanding of Diet change in Europe.
- Promoting a greater integration in research between processing, food quality and safety, nutrition/health and sustainability.
- Updating the training of food science/-engineering students, in order to avoid exclusive specialization, and enabling the initiation of research across the borders of scientific disciplines.
- Supporting infrastructural improvements for reducing "time to market" of new scientific developments within SMEs, in particular, their ability to innovate and interact successfully with the large and multinational enterprises. In the agricultural supply industry and retail sectors this depends on co-operation initiatives and the provision of external co-ordination support.
- Reducing food waste in the value chain.
- Realistic microbial shelf life determination in real time.
- Developing novel non-destructive tools and methodologies for evaluation of food.
- Increasing the use of modelling and ICT developments for improved processing and quality, in particular, for online control and process management.
- Promoting novel packaging innovations, especially using nano-materials and the increasing the use of sustainable packaging.
- Re-evaluating existing processes in terms of sustainability.
- Transformation of waste into products for a different sector.
- Examining the potential of traditional foods as a tool for functional foods production.
- Facilitating the development of small scale processing.
- Developing decision support tools for SMEs on food processing and packaging issues.
- Developing greater understanding of Out-of-home consumption, meal patterns and eating habits
- Making food consumer science actionable for SMEs
- Understanding management needs *from a perspective of SMEs.*

8) How could Horizon 2020 Societal Challenge 2 best contribute to EU policies, and leverage and complement Member States' efforts for growth and job creation?

Societal Challenge 2 can best contribute to EU policies by ensuring that complementary funding is promoted within the member states aimed at the same objectives, namely, improving the health of the European consumer and developing innovation opportunities in our food SMEs by ensuring healthier, safer, more consumer accepted new products and processes and by ensuring that food security is enhanced within the European population.

Increased innovation within our SMEs will necessitate improved communication to SMEs, aided by both European and National policies. This will necessitate exchanging reliable information and using appropriate communication technologies including direct contact on a national level to companies and associations and establishing measures to motivate food researchers to see their work in a larger societal context. There will be a need for collaboration with other stakeholders along the food chain,

especially using interdisciplinary groups and through maximizing the 'cross-over' technologies already established in other non-food sectors.

There will be a need for improved policies related to training and technology transfer. In particular by,

- Undertaking national surveys on changing R&D needs of the food industry with specific focus to SMEs;
- Developing methods for the best use of collective research, marketing and supply chain resource management activities in order to enhance innovation at food SMEs.
- Undertaking a concept design study for an educational approach to meet industry needs more effectively and for better coordination of existing training capacity.

In the area of sustainability, there will be a need to harmonise sustainability policies among all the member states whether that be related to sustainability of consumption, processing or raw materials.

In food production and processing, it will be necessary to
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between researchers developing new technologies and SMEs that must be more efficiently bridged. In some cases, innovation by SMEs is low and infrastructural improvements are necessary, as SMEs do not have the capacity to take up new technologies from the research. In other cases, the situation is exactly the opposite, and an example of this is the very successful model in Switzerland, referred to as the 'CTI projects'. These are open for SMEs, universities and start-ups where the government pays the half and the participating large companies the other half. The IP is for the small company which should be strengthened. The win-win for the larger ones is that certain processes, methods and new science & technology, which will not find in-house investment and support, can be developed by universities and SMEs which will bring the results to market. It builds on the creative strengths of SMEs and universities in quite a practical sense.

A very good opportunity for the creation of jobs will be the establishment of a Food KIC.

9) What types of cross-cutting and trans-disciplinary activities would best tackle these challenges/opportunities based on the first experience of Focus Areas such as Blue Growth or Sustainable Food Security[2]?

While of course focus areas are necessary from time to time to increase impact in chosen sectors (e.g. Blue Growth), the European food industry is so diverse that focus areas may not always be the optimum tool. For example, instead of focus areas based raw material source (Blue Growth), focus on cross sector products or on process type or technology type (e.g. nanomaterials) may be more beneficial. In other words, yes, continue to use the focus concept but ensure that it is more cross-sectorial than before.

Output and impacts

10) What type of output could be foreseen and what could the impacts (on science and technology, innovation, economy, environment and society) be based on your identification of priority areas for action? What would success look like? How would you measure it?

The European Technology Platform *Food for Life* has always considered that outputs that do not lead to rapid innovation should not be totally ignored but should not receive a high priority in the short-term. However, if the desired innovation is to materialise, there will be a need to support initiatives that bridge the gap between research outputs and their applications in specific processes and products. This gap is often left unfunded and needs to rely on industry based initiatives for implementation. While such an approach can work in scientifically well-established industrial sectors or in sectors without a major reliance on SMEs, inn the food industry, failure to fill the 'development' gap will seriously reduce innovation impact.

[2] Horizon 2020 Work Programme 2014-2015 on Societal Challenge "Food Security, Sustainable Agriculture and Forestry, Marine and Maritime and Inland Water Research and the Bioeconomy" http://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-food_en.pdf

Identification and measurement of success is difficult but not impossible. It would be relatively easy to set up a small number of 'success measurement' project consortia who would not perform innovative research per se but who would be tasked with measuring the success of Horizon 2020 initiatives in specific food sectors. Multiple key indicators would be needed as IP uptake is too crude a measurement instrument to generate good results.

11) Which related innovation aspects could reach market deployment within 5-7 years?

There are many innovation aspects that can reach market deployment within this time frame (or even less!). Many of the process-based initiatives are already close to market development but may need development funding for fruition. Likewise, food safety issues can be implemented with relative ease and sustainability innovations, while perhaps requiring significant investment, are also relatively easy to implement. In the area of consumer sciences, research outputs are immediately applicable.

Other developments concern new ingredients, often these require approvals.

Development trends with highest potential concern currently: innovations in the field of pleasure food, food contributing to a healthy diet and convenience food. Innovations can be expected in sectors such as:

Frozen and dairy, products, including cheeses, ready to eat meals, meat delicatessen, poultry, soft drinks, biscuits, chocolates, snacks, alcoholic beverages.