1.15. Optimising the efficiency and effectiveness of healthcare systems and reducing inequalities through evidence based decision making and dissemination of best practice, and innovative technologies and approaches.

There is a need to support the development of health technology assessment and health economics, as well as the of gathering evidence and dissemination of best practice and innovative technologies and approaches in the healthcare sector, including ICT and e-health applications. Comparative analyses of the reform of public health systems in Europe and in

Finally, there is a need to support the assessment of patient safety solutions and quality assurance systems, including the role of patients on safety and quality of care.

Support provided will cover the full spectrum of activities from knowledge and technology transfer to large scale demonstration actions, leading to scalable solutions for Europe and beyond.

2. FOOD SECURITY, SUSTAINABLE AGRICULTURE, MARINE AND MARITIME RESEARCH AND THE BIO-ECONOMY

2.1. Sustainable agriculture and forestry

Appropriate knowledge, tools, services and innovations are necessary to support more productive, resource-efficient and resilient agriculture and forestry systems that supply sufficient food, feed, biomass and other raw-materials and deliver ecosystems services while at the same time supporting the development of thriving rural livelihoods. Research and innovation will provide options for integrating agronomic and environmental goals into sustainable production, thus: increasing productivity and resource efficiency of agriculture; reducing agricultural greenhouse gases (GHGs) emissions; reducing leaching of nutrients from cultivated lands into terrestrial and aquatic environments; decreasing dependence from international plant derived protein imports to Europe; increasing the level of biodiversity in primary production systems.

2.1.1. Increasing production efficiency and coping with climate change, while ensuring sustainability and resilience

Activities will enhance productivity as well as the adaptive capacity of plants, animals and production systems to cope with rapidly changing environmental/climatic conditions and increasingly scarce natural resources. The resulting innovations will help to move towards a low energy, low emission and low waste economy, along the entire food and feed supply chain. In addition to contributing to food security, new opportunities will be created for the use of biomass and by-products from agriculture and forestry for a wide range of non-food applications.

Multi-disciplinary approaches will be sought to improve the performance of plants, animals, micro-organisms, while ensuring efficient resource use (water, nutrients, energy) and the

ecological integrity of rural areas. Emphasis will be placed on integrated and diverse production systems and agronomic practices, including the use of precision technologies and ecological intensification approaches to benefit both conventional and organic agriculture. Genetic improvement of plants and animals for adaptation and productivity traits will call for all appropriated conventional and modern breeding approaches and for a better use of genetic resources. Due attention will be given to on-farm soil management for increasing soil fertility as a basis for crop productivity. Animal and plant health will be promoted and integrated disease/pest control measures will be further developed. Strategies for the eradication of animal diseases including zoonoses will be tackled along with research on antimicrobial resistance. Studying the effects of practices on animal welfare will help meet societal concerns. The above listed areas will be underpinned by more fundamental research to address relevant biological questions as well as to support the development and implementation of Union policies.

2.1.2. Providing ecosystem services and public goods

Agriculture and forestry are unique systems delivering commercial products but also wider societal public goods (including cultural and recreational value) and important ecological services such as functional and in-situ biodiversity, pollination, water regulation, landscape, erosion reduction and carbon sequestration / GHG mitigation. Research activities will support the provisions of these public goods and services, through the delivery of management solutions, decision-support tools and the assessment of their non-market value. Specific issues to be dealt with include the identification of farming/forest systems and landscape patterns likely to achieve these goals. Shifts in theactive management of agricultural systems - including the use of technologies and change of practices - will increase GHG mitigation and the adaptive capacity of the agriculture sector to the adverse effects of climate change.

2.1.3. Empowerment of rural areas, support to policies and rural innovation

Development opportunities for rural communities will be mobilised by strengthening their capacity for primary production and delivery of eco-systems services as well as by opening avenues for the production of new and diversified products (food, feed, materials, energy), which meet the increasing demand for low-carbon short-chain delivery systems. Socio-economic research along with the development of new concepts and institutional innovations is needed to ensure cohesion of rural areas and prevent economic and social marginalisation, foster diversification of economic activities (including service sector), ensure appropriate relations between rural and urban areas, as well as facilitate knowledge exchange, demonstration, innovation and dissemination and foster participatory resource management. Also, there is a need to look at ways in which public goods in rural areas can be converted into local/regional socio-economic benefits. Innovation needs defined at regional and local levels will be complemented by cross-sectoral research actions at inter-regional and European levels. By providing the necessary analytical tools, indicators, models and forward looking activities, research projects will support policy makers and other actors in the implementation, monitoring and assessment of relevant strategies, policies and legislation, not only for rural areas but for the whole bio-economy. Tools and data are also required to allow for proper assessment of potential trade-offs between various types of resource use (land, water and other inputs) and bio-economy products. Socio-economic and comparative assessment of farming/forestry systems and their sustainability performance will be addressed.

2.2. Sustainable and competitive agri-food sector for a safe and healthy diet

Consumer needs for safe, healthy and affordable food have to be addressed, while considering the impacts of food consumption behaviour and food and feed production on human health and the total ecosystem. Food and feed security and safety, the competitiveness of the European agri-food industry and the sustainability of food production and supply will be addressed, covering the whole food chain and related services, whether conventional or organic, from primary production to consumption. This approach will contribute to (a) achieving food safety and security for all Europeans and eradication of hunger in the world (b) decreasing the burden of food- and diet-related diseases by promoting the shift towards healthy and sustainable diets, via consumer education and innovations in the food industry (c) reducing water and energy consumption in food processing, transport and distribution and (d) reducing food waste by 50 % by 2030.

2.2.1. Informed consumer choices

Consumer preferences, attitudes, needs, behaviour, lifestyle and education will be addressed, and communication between consumers and the food chain research community and its operators will be enhanced in order to improve informed choice, sustainable consumption and their impacts on production, inclusive growth and quality of life, especially of vulnerable groups. Social innovation will respond to societal challenges, and innovative models and methodologies in consumer science will deliver comparable data and lay the ground for responses to Union policy needs.

2.2.2. Healthy and safe foods and diets for all

Nutritional needs and the impact of food on physiological functions, physical and mental performance will be addressed as well as the links between diet, ageing, chronic diseases and disorders and dietary patterns. Dietary solutions and innovations leading to improvements in health and well-being will be identified. Chemical and microbial food and feed contamination, risks and exposures will be assessed, monitored, controlled and traced throughout the food and drinking water supply chains from production and storage to processing, packaging, distribution, catering, and preparation at home. Food safety innovations, improved risk communication tools and improved food safety standards will lead to enhanced consumer trust and protection in Europe. Globally improved food safety standards will also help to strengthen the competitiveness of the European food industry.

2.2.3. A sustainable and competitive agri-food industry

The needs for the food and feed industry to cope with social, environmental, climate and economic change from local to global will be addressed at all stages of the food and feed production chain, including food design, processing, packaging, process control, waste reduction, by-product valorisation and the safe use or disposal of animal by-products. Innovative and sustainable resource-efficient processes and diversified, safe, affordable and high quality products will be generated. This will strengthen the innovation potential of the European food supply chain, enhance its competitiveness, create economic growth and employment and allow the European food industry to adapt to changes. Other aspects to address are traceability, logistics and services, socio-economic factors, the resilience of the food chain against environmental and climate risks, and the limitation of negative impacts of food chain activities and of changing diets and production systems on the environment.

2.3. Unlocking the potential of aquatic living resources

One of the main features of living aquatic resources is that they are renewable and their sustainable exploitation relies on in depth understanding and a high degree of quality and productivity of the aquatic ecosystems. The overall objective is to sustainably exploit aquatic living resources to maximise social and economic benefits/returns from Europe's oceans and seas. This includes the need to optimise the sustainable contribution of fisheries and aquaculture to food security in the context of the global economy and reduce the heavy Union's dependence on seafood imports (approximately 60 % of total European sea food consumption depends on import and the Union is the world's largest importer of fisheries products), and to boost marine biotechnologies to fuel "blue" growth. In line with current policy frameworks, research activities will underpin the ecosystem approach to the management and exploitation of natural resources, and the 'greening' of the sectors involved.

2.3.1. Developing sustainable and environmentally-friendly fisheries

The new Common Fisheries Policy, the Marine Strategy Framework Directive and the Union's Biodiversity Strategy call for European fisheries to be more sustainable, competitive, and environmentally-friendly. The move towards an ecosystem approach to fisheries management will require an in depth understanding of marine ecosystems. New insights, tools and models will be developed to improve understanding of what makes marine ecosystems healthy and productive and to assess, evaluate and mitigate the impact of fisheries on marine ecosystems (including deep sea). New harvest strategies will be developed which provide services to society while maintaining healthy marine ecosystems. The socio-economic effects of management options will be measured. The effects and adaptation to environmental changes, including climate change, will also be investigated along with new management tools to deal with risk and uncertainty. Activities will support research on the biology, genetic and dynamics of fish populations, on the role of key species in the ecosystems, on fishing activities and their monitoring, on fishing sector behaviours and adaptation to new markets e.g. eco-labelling on fishing industry involvement in decision making. The shared use of maritime space with other activities, in particular in the coastal zone, and its socio-economic impact will also be addressed.

2.3.2. Developing competitive European aquaculture

Aquaculture has a large potential for the development of healthy safe and competitive products tailored to consumer needs and preferences as well as for environmental services (bioremediation, land and water management, etc) and energy production but it needs to be fully realised in Europe. Knowledge and technologies will be strengthened in all aspects of domestication of established species and diversification for new species while taking into account the interactions between aquaculture and the aquatic ecosystems, and the effects of climate change and how the sector can adapt to them. Innovation will also be promoted for sustainable production systems in inland, on the coastal zone and offshore. Emphasis will also be given to understanding the social and economic dimensions of the sector to underpin cost and energy efficient production matching with the market and consumer demands, while ensuring competitiveness and attractive prospects for investors and producers.

2.3.3. Boosting marine innovation through biotechnology

More than 90 % of the marine biodiversity remains unexplored, offering a huge potential for discovery of new species and applications in the field of marine biotechnologies, which is

foreseen to generate a 10 % annual growth for this sector. Support will be given to further explore and exploit the large potential offered by marine biodiversity and aquatic biomass to bring new innovative processes, products and services on the markets with potential applications in sectors including chemical and material industries, pharmaceutical, fisheries and aquaculture, energy supply and cosmetic.

2.4. Sustainable and competitive bio-based industries

The overall objective is to accelerate the conversion of fossil-based European industries to low carbon, resource efficient and sustainable ones. Research and innovation will provide the means to reduce the Union's dependency on fossil fuels and contribute to meeting its energy and climate change policy targets for 2020 (10 % of transport fuels from renewables and a 20 % reduction of greenhouse gases emissions). Estimates conclude that a shift to biological raw materials and biological processing methods could save up to 2.5 billion tons of CO_2 equivalent per year by 2030, increasing markets for bio-based raw materials and new consumer products several-fold. Reaping these potentials requires building a broad knowledge base and developing relevant (bio)technologies, focussing mainly on three essential elements: a) transforming current fossil-based processes by resource and energy efficient biotechnology based ones; b) establishing reliable and appropriate supply chains of biomass and waste streams and a wide network of bio-refineries throughout Europe; and c) supporting market development for bio-based products and processes. Synergies will be sought with the '*Leadership in Enabling and Industrial Technologies*' specific objective.

2.4.1. Fostering the bio-economy for bio-based industries

Major progress towards low carbon, resource efficient and sustainable industries will be supported through discovery and exploitation of terrestrial and aquatic biological resources, while minimising adverse environmental impacts. Potential trade-offs between the various uses of biomass should be examined. The development of bio-based products and biologically active compounds for industries and consumers with novel qualities, functionalities and improved sustainability will be targeted. The economic value of renewable resources, bio-waste and by-products will be maximised through new and resource efficient processes.

2.4.2. Developing integrated biorefineries

Activities will be supported to boost sustainable bioproducts, intermediates and bioenergy/biofuels, predominantly focussing on a cascade approach, prioritising the generation of high added-value products. Technologies and strategies will be developed to assure the raw material supply. Enhancing the range of types of biomass for use in second and third generation biorefineries, including forestry, biowaste and industrial by-products, will help avoid food/fuel conflicts and support economic development of rural and coastal areas in the Union.

2.4.3. Supporting market development for bio-based products and processes

Demand-side measures will open new markets for biotechnology innovation. Standardisation at Union and international levels is needed for, amongst others, determination of bio-based content, product functionalities and biodegradability. Methodologies and approaches to life-cycle analysis need to be further developed and continuously adapted to scientific and industrial advances. Research activities supporting product and process standardisation and

regulatory activities in the field of biotechnology are considered essential for supporting the creation of new markets and for realising trade opportunities.

2.5. Specific implementation actions

Beyond the general sources of external advice, specific consultations will be sought from the Standing Committee on Agricultural Research (SCAR) on a range of issues, including on strategic aspects through its foresight activity and on the coordination of agricultural research between national and Union levels. Appropriate links will be established with the actions of the European Innovation Partnership 'Agricultural Productivity and Sustainability'.

The impact and dissemination of research results will be actively supported through specific actions on communication, knowledge exchange and the involvement of various actors all along the projects. Implementation will combine a wide range of activities, including substantial demonstration and pilot activities. Easy and open access to research results and best practices will be fostered, where appropriate via databases.

The specific support to SMEs will allow for an increased participation of farms, fishermen and other types of micro-enterprises in research and demonstration activities. The specific needs of the primary production sector for innovation support services and outreach structures will be taken into account. Implementation will combine a wide range of activities, including knowledge exchange actions where the involvement of farmers and intermediaries will be actively ensured in view of summarising the research needs of end-users. Easy and open access to research results and best practices will be fostered.

Support to standard setting will be used to help accelerate market deployment for novel bio-based goods and services.

Consideration may be given to support to the Joint Programming Initiatives (JPIs) including 'Agriculture, Food Security and Climate Change'; 'A Healthy Diet for a Healthy Life'; and 'Healthy and Productive Seas and Oceans' and to implementing possible public-private partnerships in the field of bio-based industries.

Synergies with and further deployment by other Union funds related to this societal challenge, such as the Rural Development Funds and Fisheries Funds will be sought.

Forward looking activities will be undertaken across the sectors of the bio-economy, including the development of data bases, indicators and models addressing global, European, national and regional dimensions. A European bio-economy observatory shall be developed for mapping and monitoring Union and global research and innovation activities, developing key performance indicators, and monitoring innovation policies in the bio-economy.

3. SECURE, CLEAN AND EFFICIENT ENERGY

3.1. Reducing energy consumption and carbon footprint through smart and sustainable usage

The energy sources and consumption patterns of Europe's industries, transport, buildings, towns and cities are largely unsustainable, leading to significant environmental and climate change impacts. The development of near-zero-emission buildings, highly efficient industries and mass take-up of energy-efficient approaches by companies, individuals, communities and