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IMPORTANT

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COOPERATION

THEME 2
FOOD, AGRICULTURE AND FISHERIES, AND BIOTECHNOLOGY

Potential topics of the KBBE work programme 2013
January 2012

Activity 2.1: Sustainable production and management of biological resources from land, forest and aquatic environment

Area 2.1.1 Enabling research

Enabling research on the key long term drivers of sustainable production and management of biological resources (micro-organisms, plants and animals) including the exploitation of biodiversity and of novel bioactive molecules within these biological systems. Research will include 'omics' technologies, such as genomics, proteomics, metabolomics, and converging technologies, and their integration within systems biology approaches, as well as the development of basic tools and technologies, including bioinformatics and relevant databases, and methodologies for identifying varieties within species groups.

Development and exploitation of genomic data and tools, phenotyping approaches and breeding concepts to sustainable animal production systems

The genetic selection of farmed animals is a highly efficient and cost-effective method for modifying animal performance. Up to now most of the emphasis has been on the private benefits it produces for breeders, farmers, retailers and consumers (feed efficiency, milk or meat production, etc.). However the method is expected to be highly efficient for addressing other issues of major public concern, including living with environmental change, and improving animal health and welfare by harnessing now the benefits of advances in animal genetics and genomics.

To exploit and further implement whole genome sequence data and genomics tools for hunting the genetic components responsible for biological traits variation. The genetic structures of farm animal populations offer unique possibilities for the dissection of complex genetic traits. The aim is the development of innovative methodologies for analyzing the whole animal phenotype association and basic-biology phenotype association within the light of protein networks and biological pathways with the ultimate aim to better understand animal health and welfare mechanisms. All genotype and phenotype data developed during the project should be stored in an appropriate international infrastructure (repository). Strengthening partnership and widening the participation through joint research across EU and Third countries in this area of animal health will be an added value.

The project should also pave the way for settling an improved program for the education and the training of bio-informatician in animal science and the improvement of bioinformatics skills of biologists.

Funding scheme: Collaborative project (large scale integrating project targeted to SME's)

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15% or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: Tools able to link accurately genomics data from farm animals to production, welfare and health traits will help getting the full benefits from the growing amount of these genomics data extensively generated recently. This will promote animal robustness by translating genomic information to:

1- predictive biology of animal health related traits

2- test these new concepts in genomic selection.
3- novative tools for environmental impact (e.g.methane emission), welfare and product quality.
This will be fruitful to support agricultural/veterinary research but it will also extend our knowledge pertaining to human biomedical research as accurate primary annotation information from farmed animals can be used to 'reverse the flow' of data to illuminate the human genome.

Area 2.1.2 Increased sustainability of all production systems (agriculture, forestry, fisheries and aquaculture); plant health and crop protection

Increased sustainability and competitiveness, while safeguarding consumer health, decreasing environmental impacts and taking account of climate change, in agriculture, horticulture, forestry, fisheries and aquaculture through the development of new technologies, equipment, monitoring systems, novel plants and production systems, crop management through selected plant breeding, plant health and optimised production systems, the improvement of the scientific and technical basis of fisheries management, and a better understanding of the interaction between different systems (agriculture and forestry; fisheries and aquaculture) across a whole ecosystem approach. Research into maintenance of autochthonous ecosystems, development of biocontrol agents, and microbiological dimension of biodiversity and metagenomics will be undertaken.
For land based biological resources, special emphasis will be placed on low input (e.g. pesticides and fertilisers), and organic production systems, improved management of resources and novel food and feeds, and novel plants (crops and trees) with respect to their composition, resistance to stress, ecological effect, nutrient and water use efficiency, and architecture. This will be supported through research into biosafety, co-existence and traceability of novel plants systems and products, and monitoring and assessment of impact of genetically modified crops on the environment and human health as well as the possibility of their broader benefit for society. Plant health and crop protection will be improved through better understanding of ecology, biology of pests, diseases, weeds and other threats of phytosanitary relevance and support to controlling disease outbreaks and enhancing sustainable pest and weed management tools and techniques. Improved methods will be developed for monitoring, preservation and enhancement of soil fertility.
For biological resources from aquatic environments, emphasis will be placed on essential biological functions, safe and environmentally friendly production systems and feeds of cultured species and on fisheries biology, dynamics of mixed fisheries, interactions between fisheries activities and the marine ecosystem and on fleet-based, regional and multi-annual management systems.

Agro-silvo-pastoral systems for Europe

The topic will develop and demonstrate combinations of diversified arable farming, forestry, together with livestock production and the natural environment balancing the efficient use of resources like soil, water, energy and nutrients with the production of high quality products and the delivery of environmental services (such as contributing to a high level of biological diversit and carbon sequestration).
Funding Scheme: Collaborative project (large scale integrating project)
Additional eligibility criteria: The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.
Additional information: One project may be funded.
Expected impact: The project will provide better knowledge of existing agro-forestry systems and help develop agro-ecological intensified mixed agricultural systems adapted to

more pronounced stress conditions. It will support rural development and farm diversification while mitigating agriculture-borne CO2 emissions.

Legume breeding and management for sustainable agriculture as well as protein supply for food and feed

The overall objective of the topic is to increase competitiveness of grain legume crops and their use in European agriculture through (1) use of genetic resources and innovative breeding methods to allow for flexible and wider use of legumes in agriculture (2) agronomic innovations and (3) promoting the use of European legumes as a protein source for food and feed. The project will address different agro-ecological and climatic conditions and focus on European grain legume crops (i.e. exclude soya).

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 9 000 000.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: The topic will reinforce the cultivation of legumes in European agriculture, thereby increasing and diversifying protein supply for food and feed purposes as well as taking advantage of the positive effects of legumes e.g. on soil fertility and N-fixation.

Integrated approach towards small grain cereal production and diversification in Europe

Research under this topic aims at improving and diversifying European production of small grain cereals (both major and minor ones) to increase their productivity, robustness and adaptation to low(er)-input conditions. Activities will take a comprehensive approach covering the characterisation and use of genetic diversity, (further) development of genetic and genomic resources or breeding purposes as well as consider new breeding and agronomic approaches including the creation of association varieties. Due account will be taken of the different levels of breeding progress and specific needs for research as regards the different crops to be considered.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: Project results will provide the breeding sector with extended tools to accelerate the development of new varieties with improved agronomic and nutritional characteristics. By addressing both major and minor cereals, the project will extend the range of available cereal species in European agriculture, benefit from diversification and allow to transfer advances already made in main crops such as wheat and barley to so far neglected cereals such as rye and oat.

Control of pathogens affecting fruit crops

Research under this topic will provide further insight into the biology of certain pests affecting fruit production and translate this knowledge into the development of practical solutions for control of these pests and for limiting damages to fruit production. The research will target invasive pests that are a big threat and/or for which pest management is a challenge.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: Activities will result in the development of innovative solutions for pest management, reduction of yield losses, and novel phytosanitary measures or products. The presence of SMEs and industry will facilitate the translation of knowledge to practical solutions.

Biological control agents in agriculture and forestry for effective pest control

The aim of this topic is the generation of novel tools/products for biological control of a broad range of pests/pathogens affecting various cropping systems and forestry.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 35 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: The generation of innovative solutions for integrated pest management will help to maintain or increase productivity of farm and forest land while reducing the need or chemical control of pests. It will thereby also support to policy as regards implementation of Directive 2009/128/EC on the sustainable use of pesticides. The high percentage of EU contribution going to SMEs will facilitate the translation of knowledge to products for the market.

Novel practices for sustainable wood mobilisation and vegetation management in forests

The project will generate the necessary knowledge to improve practices for a sustainable mobilisation of wood and for integrated vegetation management. This will include development of innovative management practices, wood harvesting technologies, services and organizational structures to provide increased amounts of wood while respecting sustainable forest management. Understanding the motivations and decision-making among forest owners will be important. Furthermore, the project will develop new silvicultural approaches, guidelines and novel, cost-effective and low-impact alternatives to reduce or eliminate pesticide use indifferent forest types in Europe.

Funding scheme: Collaborative Project (large-scale integrating project).

Additional eligibility criteria:

– The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.
– The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: Project results will increase availability of wood to satisfy the growing demand in the forest-based industries and contribute to increased competitiveness of the sector while minimising environmental impact through a reduction in the use of pesticides and sound wood resource mobilisation.

Innovative insights and tools to integrate the ecosystem approach into fisheries advice

The Common Fisheries Policy (CFP), The Marine Strategy Framework Directive (MSFD) and Habitat directive call for the development of ecosystem based management tools to improve sustainable fisheries and environmental management, and to ensure preservation of the marine biodiversity as well as to assess the environmental status of marine waters. In order to reach an understanding of the dynamics of the marine environment, there is a need for; 1) the development and selection of useful/appropriate modelling tools with emphasis on those that go beyond the single-species approach, 2) for assessment of existing data and identification of future data requirements, 3) for evaluation of the spatial and temporal aspects of the tools identified, and evaluation of the feasibility to use the modelling tools for fisheries and environmental management 4) Create innovative solution to ensure synergy between scientists and the decision-makers.

The project will improve the decision basis for ecosystem based fisheries and environmental management. It must be of high relevance to the future management of living marine resources in Europe in a changing environment.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criteria:

- The requested European Commission contribution shall not exceed EUR 6 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on the condition that the estimated EU contribution going to SME(s) is 15% or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: The project will provided new knowledge, models and tools to support the integration of an ecosystem approach in fisheries advice and to support decision-making for ecosystem based fisheries and environmental management. It will be of high relevance to the future management of living marine resources and will support proper implementation of the new Common Fisheries Policy (CFP), the Marine Strategy Framework Directive (MSFD) and Habitat Directive.

Species and seafood products diversification in aquaculture

The aim is to explore the biological and socio-economic potential of new candidate species and subsequently support diversification of the activity in terms of species, seafood products and markets. This will require a particular effort of research and innovation in understanding new biological models, while developing adequate husbandry practices and technologies. This topic will include a strong socio-economic component with particular emphasis on the potential for adding value to aquaculture products along the seafood chain from the farm to the consumer.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).
Additional eligibility criteria:
- The requested European Union contribution shall not exceed EUR 8 000 000 per proposal.
- The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.
Expected impact: Anticipate the future success story in European aquaculture. Contribute in mining the potential offered by the large diversity of aquatic (marine in particular) organisms for seafood production. Remove bottlenecks in science, markets and consumers perception/prefernces.

Boosting the domestication of established farmed finfish species through selective breeding

Over the last years several farmed aquatic species, namely, Atlantic salmon, rainbow trout, carp, European sea bass, European sea bream and more recently turbot, have become the basis of the European aquaculture industry. Research and technological development have been key in achieving the mastering of the biological cycle of these species and allowing relatively stable productions. Targeted selective breeding will be essential for consolidating this sector and contributing in productivity gains and subsequently in increasing competitiveness of these seafood products. The main objective of this project will be to stimulate the development of breeding programmes and/or underpin the existing ones for the species mentioned above.
Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).
Additional eligibility criteria:
- The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.
- The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.
Expected impact: Provide knowledge and tools for boosting the development of breeding programmes in the European finfish farming sector. Contribute in the production of fish with traits of interest (according to the biological, physiological and environmental challenges faced by each species concerned and in particular those related to disease prevention). In the context of increasing competition from imported seafood products any gain in productivity and/or reduction of production costs would be an advantage for the sector.

"The Ocean of Tomorrow – 2013"- Fostering research and innovation on marine technologies

Biosensors for real time monitoring of biohazard and man made chemical contaminants in the marine environment

The objective of this topic is to develop innovative real-time, in situ biosensors for the detection and monitoring of high impact and presently difficult to measure analytes, such us, algal toxins, synthetic organics, herbicides/pesticides and polycyclic aromatic hydrocarbons (PAH).
Funding scheme: Collaborative Project (Large integrating project).
Additional information: more than one project might be funded.

Expected impact: Facilitate the implementation of the Marine Strategy Framework Directive. Ensure more sustainable management and exploitation of marine resources (such as fisheries and aquaculture).

Innovative sensors for in situ monitoring of marine environment and related maritime activities

The objective of this topic is to increase the availability of in-situ data to monitor the marine environment and to develop cost effective sensors and sensors' packages to collect data in-situ and data related to marine activities (in particular, fishing).
Funding scheme: Collaborative Project (Large integrating project)
Additional information: more than one project might be funded.
Expected impact: Increase the amount and availability of appropriate and reliable in-situ data. Significant impact on the implementation of EU legislation (GES of MSFD and DCR of the CFP) and on global observation initiatives (GOOS/GEOSS).

Innovative antifouling materials for maritime applications

The objective of this topic is to develop innovative and better performing functional anti-fouling materials, while better understanding of the bio-fouling process.
Funding scheme: Collaborative Project (Large integrating project).
Additional information: more than one project might be funded.
Expected impact: Advance in the solution of problems deriving from biofouling for mobile and stationary maritime structures and equipment. Develop new cost-effective and environmentally friendly materials.

Innovative transport and deployment systems for the offshore energy sector

The objective of this topic is to address transport and logistic issues relevant to the development of offshore wind farms in relation to their cost-effective installation, maintenance, operation and decommissioning as well as to related transport, logistics and equipment needs.
Funding scheme: Collaborative Project (Large integrating project).
Additional information: more than one project might be funded.
Expected impact: Contribute to the implementation of the European Wind Initiative aiming at supporting offshore take-off in the medium term. Develop a niche market for shipbuilding and shipping sectors, supporting their competitiveness and creating new jobs.

Area 2.1.3 Optimised animal health, production and welfare across agriculture, fisheries and aquaculture

Optimised animal health, production and welfare, across agriculture, fisheries and aquaculture, inter alia *through the exploitation of genetic knowledge, new breeding methods, improved understanding of animal physiology and behaviour and the better understanding and control of pests, parasites and infectious animal diseases and other threats to the sustainability and security of food production, including zoonoses. The latter will also be addressed by developing tools for monitoring, prevention and control, by underpinning and applied research on vaccines and diagnostics, studying the ecology of known or emerging infectious agents and other threats, including malicious acts, and impacts of different farming*

systems and climate. New knowledge for the safe disposal of animal waste and improved management of by-products will also be developed.

Emerging vector borne diseases with emphasis on zoonotic haemorrhagic fevers

There is a close proximity and possible link between the African and European continent in relation to animal health and to the interface of animal and human diseases, in particular vector borne diseases. Among those some are potentially to cause major sanitary problems of international interest and proportion: Rift Valley fever (RVF) and Crimean-Congo haemorrhagic fever (CCHF) as zoonotic diseases, African horse sickness (AHS), including equine encephalosis. Rift Valley Fever had reached the north of Egypt. There is a need to overcome substantial knowledge gaps on how to deal with the disease in Europe, both in human and in livestock. An epidemic of CCHR took place in Turkey from 2002 to 2008 with more than 2500 persons showing symptoms of the disease and around 130 died. In affected areas the fatality rates in human patients have ranged from 10 to as high as 50%. AHS is so far contained to the African continent; however equine encephalosis has already spread into the Middle East thus indicating the possible pathways of AHS incursion into this area. In several countries neurological cases were detected in equines and humans, causing health problems and social alerts.

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 3 000 000 per proposal.
- The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 20 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Sustainable apiculture and conservation of honey bee genetic diversity

The aim of this topic is to build innovative research on underlying resistance mechanisms to infectious and parasitic diseases in honey bees together with maintaining the diversity of endemic honeybee races in Europe (and in Africa?). Taking into account the prevailing role of the ectoparasite mite *Varroa destructor* and the associated viruses, the research shall focus on the comprehensive understanding of natural resistance mechanisms of honeybees against the mite both as genuine parasite and in its role as virus vector. The research shall start from molecular processes to population wide epidemiology and develop strategies calling for a sustainable control of *Varroa* based on the disruption of the mite behaviour and/or physiology with the aim, on the long-term, of a therapy free approach.

The research will combine expertise in molecular genomics and transcriptomics, molecular physiology, behavioural sciences and virology, as well as apicultural and developmental extension. At the same time the research will explore how genetic diversity of honeybees could be protected by integrating biological, economical and social components and how it can be utilised to enable sustainable apiculture production and preserve the pollinator role of bees in agriculture.

Funding scheme: Collaborative project (large scale integrating project)

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.
- The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.

Expected impact: Although *V. destructor* is not the sole cause of each and every colony loss, it has now repeatedly shown to be a key factor for colony death. Removing the muite from the complex equation of honeybee health removes the pressure on the honeybee's extensive natural defense against other health challenges. Using sustainable Varroa control will ease beekeepers and help to re-establish wild and feral bee populations, thus promoting pollination-dependent agriculture, ensuring both food security and pollination services in natural ecosystems. Combining this research together with honey bee genomic diversity will allow to anticipating further threats and emerging diseases like what happened with the CCD and face future environmental changes. It will help to integrate beekeepers in stock improvement programmes instead of relying on a few sources of queens. Economically this approach will provide potential for new income through pollination services and selected bee stock marketing.

Sustainable animal production: integrating animal health and welfare aspects

The aim of this topic is to contribute to understand the multi-factorial dimension (infectious agents, genetics, nutrition, and management factors) of animal pathologies linked to the intensification of production, so-called "production diseases" and to help to provide effective control strategies to reduce the impact on animal health and welfare.
The research will target at least pig and poultry pathologies like for example morti-natality, leg disorders(s), metabolic disorders etc. It will consider the various aspects of the production system: breeding-genomics, feeding, animal health parameters, animal-based welfare indicators, bio-security and hygiene, and husbandry practices. Socio-economic aspects should be carefully analysed with the impact on the costs and efficiency of production and in particular, those related to welfare improvement. The approach should target intensive farming systems where "production diseases" are likely to be more prevalent.
Funding scheme: Collaborative project (large scale integrating project)
Additional eligibility criteria:
- The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
- The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 20 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.
Expected impact: Better understanding of the various factors involved in "production diseases" in pigs and poultry will help to propose adequate and effective multi-factorial control strategies. Economic analysis of the strategies proposed will help to increase competitiveness of the livestock industry. In addition, a sustainable management of livestock production will contribute to the production of better quality products in a welfare friendly approach that will match consumers' expectations.

Coordination of research between EU and China on major infectious diseases of animals and zoonoses

Due to globalisation of food production, including meat, milk and eggs, animal infectious diseases have the potential for very rapid spread irrespective of national borders, causing serious socio-economic and possibly public health consequences. China is a major player in livestock with half of the world swine industry together with an intensive poultry production and a growing cattle industry. International trade of animal product is constantly increasing.
A wider co-ordination of research activities from the EU and China in the field of animal disease will improve scientific collaborations for the benefit of food safety and food security.

This EU-China action would focus on major viral diseases affecting poultry, pigs and cattle with
i) Twinning of projects (funded by the counterparts' programmes)
ii) Technical workshops (on diagnosis methods and epidemiological control tools)
iii) Exchange and training of scientists, especially young ones
iv) Dissemination of results (organisation of meetings, exchanges of information by web-conference, etc). This action will provide a long term vision on future common research activities and will contribute to the international policies of the EU.
Funding scheme: CSA
Additional eligibility criteria:
– The requested European Union contribution shall not exceed EUR 1 000 000 per proposal.
Additional information: One project may be funded.
Expected impact: The project will ensure a wide-range networking of the relevant scientific communities and stakeholders and the systematic establishment of linkages between on-going animal health research, training programmes and innovation projects in the veterinary field from the EU and China. This co-ordination of research activities in the field of animal disease control will keep collaborations already established and scale-up EU-China collaboration, in line with the EU-China S&T co-operation agreement. The project will also improve training opportunities for EU researchers.

Ecology of drug resistant bacteria and transfer of antimicrobial resistance in livestock production and throughout the food chain

The increasing resistance to antimicrobial drugs has become a major threat to human and animal health worldwide. Overuse and misuse of antimicrobial substances have favoured the development of resistant organisms and consequently limited their therapeutic value. Antimicrobial resistance may spread to humans via direct contact with farm animals, consumption of contaminated food or via contaminated soil or waterways. Transferable resistance determinants are of particular concern in this respect. Food-borne antimicrobial resistance has the potential to cause difficult to treat infections resulting in extra suffering, mortality and costs. Therefore, there is a need to analyse the epidemiology and resistance mechanism of antimicrobial resistance in animals and the food chain. The project should focus on the role of the total food chain as reservoir and disseminator of antimicrobial resistance and virulence genes and should improve the understanding of the major origin and transmission of antimicrobial resistance in animals and the food chain. Research should include surveillance of resistant bacteria in the farm environment, animal intestine, waste streams from farm production and also in foodstuffs. On farm antibiotic usage will be correlated with occurrence of bacteria with antibiotic resistance. Research should evaluate the animal health and economic impacts of antimicrobial resistance in animal production and review ways to reduce it. It should address as far as possible the environmental impact.
Funding scheme:
Collaborative Project (large-scale integrating project).
Additional eligibility criterion:
– The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
– The project will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 15 % or more of the total estimated EU contribution for the project as a whole.

Additional information: One project may be funded.
Expected impact: The generated knowledge would allow evaluating animal health and economic impact of antimicrobial resistance in the total food chain, and minimising the

transfer and dissemination of antimicrobial resistance and the emergence of bacteria with newly acquired virulence traits. The European added value lies in contributing to the EU policies on combating antimicrobial resistance, strengthening the competitiveness of European food producers, improving food safety and enhancing consumer trust.

Area 2.1.4 Socio-economic research and support to policies

Providing the tools needed by policy makers and other actors to support the implementation of relevant strategies, policies and legislation and in particular to support the building of the European Knowledge Based Bio-Economy (KBBE) and the needs of rural and coastal development. The Common Fisheries Policy and the new European Maritime Policy will be supported through a whole ecosystem approach for the harvesting and the farming of marine resources. Research for all policies, including the Common Agricultural Policy, will include socio-economic studies and cost-benefit analysis, comparative investigations of different farming systems including multifunctional ones, cost-effective fisheries management systems, the rearing of non-food animals, interactions with forestry and studies to improve rural and coastal livelihoods.

ERANET+: Agriculture, food security and climate change

ERANET+: Mediterranean agriculture

ERANET+: Organic food and agriculture

ERANET: Sustainable Forest Management (SFM) and Multifunctional Forestry

ERANET: Rural areas and agriculture

ERANET: ICT and robotics in agriculture

Boosting the translation of FP projects' results into innovative applications in the field of agriculture and forestry

The main aim of this topic is to allow building on results from projects funded under EU Framework Programmes (FP5, FP6, FP7) and ERA-Nets in the field of agriculture and forestry, to prove the technical and economic viability of methodologies, processes, prototypes, models, technologies etc. -developed under these projects- that offer a potential economic interest but which cannot be commercialised directly. Eligible RTD and demonstration activities under this topic will focus on specifications, testing and validation of existing results of FP programmes for reaching the last development stage before products or processes enter the production and/or the market. Proposals must fit into the overall business and innovation needs of the SMEs involved and must demonstrate clear exploitation potential and economic benefits for them. Applicants must be owners of the IPR of the results and knowledge to be used in their application and the proposals must clearly and convincingly describe how this knowledge/technology will be brought forward enough to reach the stage of innovative application.

Funding scheme: Collaborative Project (small or medium-scale focused research project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 1 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on the condition that the estimated EU contribution going to SME(s) is 75 % or more of the total estimated EU contribution for the project as a whole.
- Maximum duration 2 years.

Additional information: Up to five projects may be funded.

Expected impact: This topic is expected to contribute in tackling the paradox of EU research, i.e. being world leader in producing high level scientific knowledge but underperforming in terms of translation into applications and innovative products and services. Considering the specificities of the economic sectors falling under this activity of the KBBE, this topic is expected to contribute in paving the way from the development of scientific knowledge and technologies to the market by stimulating the development of new patents, dedicated business plans and innovative marketable applications.

Improving the capacity of agro-meteorological crop modelling to integrate climatic variability and extreme weather events

The aim of this topic is to improve food security by better cope with modelling of extreme weather events. In the framework of discussions related to food security and to the functioning of markets, whether at EU or world level, the capacity to produce short-term production forecasts is becoming increasingly important. In the EU a capacity to produce yield forecasts on the basis of agro-meteorological models has been developed in the last 20 years. These short-term forecasts are utilised, among others, by the Directorate General for Agriculture and Rural Development as part of its monitoring of agricultural markets. At the world level, agro-meteorological models are important tools to monitor food security and are at the root of early warning systems.

For addressing climate change impacts on global food production, food security and food prices need to better integrate effects of changes in climatic variability and extremes, including heat waves, droughts and floods, into crop model assessments. Previous assessments have failed to account sufficiently for such effects which, given current projections of increases in some extreme weather phenomena under climate change, may lead to a severe underestimation of yield losses and yield variability under increase of extreme climatic events projected within climate change scenarios.

The project will aim at improving the capacity of agro-meteorological models to project the impact of extreme weather events. Extreme events are expected to increase under climate change. The research should aim to assess the capacity and the ability of the existing modelling approaches, both based on deterministic and on stochastic or probabilistic approaches, to address the impact of climatic shocks or extreme events on crop yield forecasts and crop biomass formation. The project should look at the assessment taking into account crop system diversity by geographic area.

Given the importance of the subject and the variety of types of extreme events, it is expected that this project will involve several research communities outside the EU.

Project results are expected to lead in an improvement of the capacity of agro-meteorological models to better deal with extreme events. At the EU level, this is expected to lead to better short-term forecasts. At world level, project results should contribute to improve food security monitoring and early warning systems.

Funding scheme: Collaborative Project (small-scale integrating project).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 2 000 000

Additional information: One project may be funded.

Expected impact: Project results are expected to lead in an improvement of the capacity of agro-meteorological models to better deal with extreme events. At the EU level, this is expected to lead to better short-term forecasts. At world level, project results should contribute to improve food security monitoring and early warning systems.

Assessment of organic aquaculture for further development of European regulatory framework

The aim of this project is to support the fast growing market for organic aquaculture with the appropriate regulatory framework to further enhance its economic development. Organic aquaculture is a relatively young market segment, which as of 2009 is regulated at the EU level (EC Regulation 710/2009). An assessment of existing research is needed and some selected studies on controversial issues which are not sufficiently addressed in the regulation, such as requirements to use sustainably produced feed, stocking density and sourcing organic juveniles.

Further assessment are needed to support a possible revision of this regulation (currently planned for 2013). Impact assessments of different organic aquaculture production systems and management strategies, nutritional resource utilization, fish welfare as well as the environmental impact for different fish species and production sites are needed. Different applied strategies for health maintenance and alternative veterinary treatments have to be assessed and optimal slaughtering procedures should be evaluated. Production - environment interactions need to be analysed to uncover thresholds for an eco-functional intensity of organic production in line with organic farming principles. Socio-economic investigations of the relationship between organic certification and competitiveness as well as studies on consumer perceptions and sentiments are necessary to guide farmers, regulators, policy makers as well as market actors towards the acceptance of this innovative new sector and to promote its further development. The project should take full account of other EU and national research projects on aquaculture where relevant for the organic aquaculture regulatory framework.

Funding scheme: SSA

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 1 500 000.

Additional information: O project may be funded.

Expected impact: Providing scientific advice on the right regulatory framework, the project will contribute to the further economic growth of this dynamic sector. The results will create a scientific basis for the future revision of the EU rules for organic aquaculture taking into account different fish species and climatic conditions. The results in the field of organic aquaculture research will also benefit to the conventional sector. Substantial scientific knowledge and policy recommendations regarding stocking densities, feed issues and welfare will be expanded for a code of conduct of organic aquaculture production for different European contexts (Mediterranean, Atlantic, Middle European, Nordic, etc.) and as a basis for community-wide development and promotion. Consumer confidence will improve based on the broad dissemination of the obtained scientific knowledge and good communication from stakeholders.

Agriculture and trade development in EU`s Eastern Neighbours

The aim of this topic is to gain a better understanding of the agricultural production potential and the role it could play for Europe and internationally.

Several countries of the Commonwealth of Independent States (CIS) have sizeable agricultural sectors. This does not apply only to Ukraine and Russia which are major players

in the arable crop sector on world markets but also other countries such as Moldova which is an important fruit and vegetable and wine producer and exporter.
The sheer weight of the agricultural sector in Russia and in Ukraine and the implication for international and EU trade call for a better knowledge and monitoring of current and potential development of their sector. The need for an appropriate knowledge applies obviously to the grain sector, for which Russia and Ukraine are strong competitors on world markets, but extends, for example, to their potential to produce biomass for material and energy use, to the restructuring of the processing industry and the implications for the future competitiveness of these countries and potential foreign direct investment.
The development of international trade in agriculture of these countries depends upon the dynamics of the sectors but also on their participation in trade agreements. This concerns the EU with which so-called Deep and Comprehensive Free Trade Agreements (DCFTA) are being negotiated and also intra-regional trade with the customs union between Russia, Belarus and Kazakhstan.
The research project will aim at investigating the development of the agriculture, food and non-food sectors and of the policies implemented in Armenia, Azerbaijan, Georgia, Kazakhstan, Moldova, Russia and Ukraine. The investigation will cover in full details the major sectors in these countries. All policies with a bearing on the development of the sector will be analysed (the various elements of agricultural policy, trade policy, industrial policy, macro-economic policy, etc.). In addition, the policy analysis will extend to all areas which are important for trade and business development, such as: SPS standards, tax policy, FDI, IPR, contract enforcement, etc. In order to provide insights on medium-term possible development, modelling of the sector in the major countries (in particular Ukraine and Russia) on the basis of partial equilibrium model will be explored.
Regarding trade in agriculture and food products, the potential/actual impact of the DCFTAs with the EU will be analysed through economic modelling. The impact of the Customs Union between Belarus, Russia and Kazahkstan on the investment climate as well as bilateral trade relations with the EU will be analysed also.
Funding scheme: Collaborative Project (small-scale integrating project).
Additional eligibility criteria: The requested European Union contribution shall not exceed EUR 1 500 000.
Additional information: One project may be funded.
Expected impact: The project will provide useful insights in sectoral and policy developments in the concerned countries. It will also deliver simulations / impacts of bilateral trade agreements. This will entail better informed bilateral trade relations between these countries and the EU.

Support to agricultural policy

The task is based on 4 sub-tasks
Funding scheme: Collaborative Project
Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 8 000 000 per proposal for a proposal combining all sub-tasks a-d, the indicative EU contribution per sub-task would be: 2 500 000 for sub-task a and the rest equally allocated to each sub-task

Additional information: One project may be funded.

a) Measurement of impact of research in the agriculture of the EU,

The aim of this topic is to better target public agricultural research spending in the EU. It is estimated that public research dedicated to the agricultural sector amounts to above €3 billion per year in the EU (Eurostat, GBAORD data). In addition, the private sector invests sizeable

amounts, although there are no statistical data dealing with private investments in research. It is usually assumed that every €1 invested in public research attracts another €2 from the private sector, yet it is still to be checked whether this rule of thumb is still relevant.
The assessment of the impact of research in the development of the sector is arduous. The major works (done in particular by Alston) focus on productivity growth. Apart from the difficulty of attribution of productivity growth to research, another difficulty of measuring the impact in terms of productivity is that a large body of research is meant to achieve other objectives than increasing productivity (increase sustainability, etc).
Investigate the public and private effort in research in the agriculture and related sectors and develop tools to measure the impact of agriculture research: impact on productivity but on other research objectives.
Methodology:
- Analysis of current research expenses both public and private (trends, sources, objectives) in agriculture;
- Economic modelling to measure impact on productivity and other indicators, time lags, etc.
- Case studies or other methods for the measurement of impacts taking into account such aspects as: process (programming, stability of funding, structures, public-private partnership, coordination), distinction between fundamental research / applied research, factors of success of implementation of results on the ground level.
The project will provide recommendations regarding the improvement of the delivery of research.
Expected impact: The project will deliver a thorough picture of agricultural research in the EU. It will deliver tools enabling to better evaluate short-term and long-term impacts of research and recommendations. These elements will allow policy makers and other stakeholders at Member State and EU levels to better design and implement research programmes in agriculture.

b) Monitoring and evaluation of the Common Agricultural Policy: establishing and testing farm-level indicators

The aim of the project is to develop improvements for the monitoring and evaluation of the CAP in order to achieve better targeting of policy measures. Since its inception, the Common Agricultural Policy (CAP) has had to cater for an ever increasing range of objectives. The original market stabilisation and income support goals have been augmented by including environmental sustainability and the contribution of agriculture to climate change adaptation and mitigation. With the CAP post-2013, the aim will be to better align the policy to the objectives and targets of the Europe 2020 framework such as innovation or resource efficiency.
It will therefore be important as part of the monitoring and evaluation of the future CAP to have an in-depth picture of the impact of the CAP at farm level. The scope of issues to be covered imply to work on the basis of data collected with a representative sample of farms across the EU. Therefore, there is a need for the establishment of a monitoring and evaluation infrastructure of the CAP on the basis of farm-level indicators. For reasons of coherence and synergies, this initiative will have strong links with FADN.
Research questions will be the following:

- **Indicators, data and proxies: address methodological questions on relevant indicators and data, including methodologies for determination of net impacts and establishment of counterfactuals** for measuring the impact of the CAP at farm level across a large array of fields, including farm economics, environmental sustainability (including impact of agri-environmental measures, greening of direct payments, Natura 2000, High Nature Value areas, etc.), knowledge transfer and innovation and other societal needs and in relation to the range of CAP instruments (e.g. rural development

measures, direct payments, market measures, etc.). The methodology should allow analysing the jointness between the different objectives of the CAP at farm level (e.g. economic impact of environmental objectives of the CAP). The scheme will monitor at least the following variables at farm level: economics (income, productivity, input/output terms of trade), environment (biodiversity, soil, emissions and water), social (employment).

- **Develop an approach suited to contribute to the monitoring and evaluation of the CAP** taking into account existing relevant initiatives and methodologies (e.g. agri-environmental indicators, Common Monitoring and Evaluation Framework for Rural Development, OECD indicators, etc.);
- Establish **a pilot network** of farms (representing EU farm diversity), well suited for the gathering of data on the basis of farm-level indicators with a view to test indicators and methodologies.

Expected impacts Significant contribution to the field of policy evaluation relevant to the CAP but also to other EU and national policies (e.g. environmental policies); Lessons learned and recommendations to be utilised for the establishment of an operational EU-wide system at the European Commission, contributing to the overall monitoring and evaluation system of the CAP.

c) Fostering participatory approaches for local development in rural areas: the impact of Leader,

The aim of this topic is to extend the success of Leader to a broader context of innovation. Leader projects have become an important tool to support local development initiatives which have contributed to the economic development of rural areas. At a time when innovation has become an objective cutting across different EU policies, an overall assessment of the contribution of Leader approaches to social and organisational innovation has yet to be made.

No in-depth research on the impact of Local Development Strategies (LDS) within Leader have been made so far, the last FP project dealing with Leader was PRIDE which investigated the partnership dimension of Leader. The lack of systematic knowledge at EU level is compounded by the fact that no analysis is made at LDS level in rural development programme evaluations. At a time when Europe 2020 is meant to foster green, smart and inclusive growth, the EU policy maker turns to miss a thorough assessment of the approaches adopted by Leader and their contribution to the economic development in rural areas. The large number of Leader projects that have taken place across the EU represents an untapped source of information for a systematic research work on participatory approaches to innovation.

The research will investigate various dimensions of the Local Development Strategies:

- Taxonomy of the various approaches, strategic themes, diversity and homogeneity of LDS across time and geography;
- Analysis of the multi-governance under Leader and interrelations between global and local development processes. How are global agendas translated locally (e.g. contextualisation/local adaptation of global agendas; local interpretation of global agendas) and local agendas taken into account at a more global level?
- To which extent are LDS an "avant-garde" of innovative solutions that will later become regimes?
- From a policy point of view what is the appropriate degree of autonomy in relation to the development of the local strategy respecting both the bottom up principle and the programme efficiency?

The methodology will rely on the relevant social sciences (economics and sociology of innovation) and will draw on an important survey work and case study analysis.

Expected impact: Better understanding of the potential benefits of the Leader approach for an innovation concept; development of a tool kit for the assessment of Leader projects and classification and clustering of themes tackled by LDS. Delivery of good practices and lessons learnt for use for policies meant to foster innovative approaches. These insights will contribute to future design of rural development policies;
Identification of emerging themes of LDS as potential rural development issues for tomorrow.

d) Importance of migrant seasonal labour in agriculture

The aim of this topic is to contribute to an inclusive Europe by better policies to address migrant seasonal labour in agriculture in Europe. Although badly documented by statistical data, (migrant) seasonal workers play a significant role in the agriculture sector. This concerns migrants from EU Member Countries (e.g. workers from Bulgaria to Greece), migrants from outside the EU (e.g. from northern Africa, Ukraine, etc.), local (unemployed) rural population and student labour flows within Europe. Working conditions in the various Member States differ according to the legal framework, the countries of origin of the workers, the legal status of the workers and the facilities put in place to respond to the needs for labour of the concerned agriculture sub-sectors. Some Member States have put in place policies which allow for appropriate conditions for the workers, in some other Member States, seasonal (migrant) work takes place in less favourable conditions. In particular access to proper working and housing conditions, to social security and welfare, is not always assured. Synchronisation between social unemployment schemes and options for unemployed to provide seasonal labour are most often missing as well as opportunities/procedures/schemes for farmers to select and arrange in advance their seasonal labour needs.
The Commission's Jobs and growth in rural areas Communication and its Staff working document (2007) estimate that in 2002, for example, the number of seasonal farm-workers in the EU-15 was about 4.5 million, corresponding to at least 1 million full-time employees. With the EU enlargements of 2004 and 2007 and the few million additional farms that joined the EU farm society, the scope of the issue has enlarged significantly.
The EU strategy 2020 assigns a strong importance to inclusive growth. In the case of agriculture and the rural economy at large, this inclusiveness can play a potentially important role by raising seasonal labour conditions, improving jobs' quality and reducing poverty levels. This does not concern only social welfare and labour conditions but the interactions and integration of seasonal workers in the local economy and communities.

- Assess the evolution and significance of (international) migrant labour in the agriculture sector of the EU with a focus in the largest concerned Member States / sectors
- Assess the conditions surrounding seasonal labour: labour conditions, housing, access to social welfare and to other services, integration in local communities
- Review the policies (sector / government) implemented in the Member States with a view to facilitate recruitment / welfare / integration, etc. and also the local innovations put in place to improve the conditions of seasonal workers.

Apart from statistical data which will cover some aspects a large part of the data will be collected by surveys at farm / local community level. These surveys should allow to cover several seasons (at least two) in the same places. Additional information should be gathered from interviews with local, regional and national public authorities, business associations, labour organisations. Various social sciences will be involved including sociology and economics. The research will also rely on case studies involving the following countries / Member States:

- Member States / countries of origin of migrants: Bulgaria, Hungary, Poland, Romania, Western FSU countries, northern African countries
- Member States of work: Belgium, France, Italy, Germany, Greece, Spain, Austria, Portugal, Cyprus, the United Kingdom

Expected impact: The research will shed light on a badly informed range of issues. It will also deliver policy recommendations and provide examples of social innovations which will be of interest to the policy makers and the local communities. It is expected that the recommendations and innovation examples will allow to improve the inclusiveness of (migrant) seasonal work in the EU.

Activity 2.2: Fork to farm: Food (including seafood), health and well being

Understanding consumer behaviour and consumer preferences as a major factor in the competitiveness of the food industry and the impact of food on the health, and well-being of the European citizen. The focus will be on consumer perception and attitudes towards food including traditional food, understanding societal and cultural trends, and identifying determinants of food choice and consumer access to food. The research will include the development of data bases on food and nutrition research.

Area 2.2.1 Consumers

Understanding consumer behaviour and consumer preferences as a major factor in the competitiveness of the food industry and the impact of food on the health, and well-being of the European citizen. The focus will be on consumer perception and attitudes towards food including traditional food, understanding societal and cultural trends, and identifying determinants of food choice and consumer access to food. The research will include the development of data bases on food and nutrition research.

KBBE.2013.2.1-01: Impact of food, lifestyle and the socio-economic environment on depression and proposed remedial actions

Depression is one of the most prevalent, severe and disabling disorders in the EU and poses a heavy burden on individuals and families, creates growing challenges for health and social welfare systems and causes high productivity losses for the EU-economy. The size of the disease and disability burden of depression, and the EU's dependence on a healthy population and workforce, require considerable research efforts into depression leading to clear social innovation tools. The project shall tackle this societal challenge through providing a comprehensive picture of depression that integrates knowledge of biological and psycho-social dimensions (including a gender perspective). It shall also analyse the multi-faceted links between depression and nutrition (food intake, food composition, and nutritional behaviour), against the background of changes and trends in lifestyle factors, and wider social determinants. Consideration shall be given to the influence of behavioural factors (new forms of social communication, physical activity, etc), the social environment (families, partnerships, workplace, etc.) and fundamental societal transformations, such as the ageing population, the changing nature of work, and social and economic uncertainties. The project should analyse relevant risk and protective factors. The role of health and other relevant policy areas should be analysed. Research in this area requires a holistic and innovative approach in close collaboration with many different actors and sectors. The call is aiming at unipolar depression only. Research on clinical treatment is not included in this call.
Funding Scheme: Collaborative Project (large-scale integrating project).
Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.
Additional information: One project may be funded.

Expected impact: 1) The European added value of this topic will be research carried out in order to further fill existing gaps in the understanding of the complex nature and causes of depression as serious burden for individuals and their families as well as for the socio-economic welfare of a society and therefore lead to real social innovation. 2) A European reference study on depression shall be established, to guide policy at EU- and Member State levels, relevant stakeholders and practitioners as well as citizens in dealing with depression and taking preventative measures.

Area 2.2.2 Nutrition

Understanding beneficial and harmful dietary factors as well as the specific needs and habits of population groups as a major controllable factor in the development and reduction of occurrence of diet-related diseases and disorders including obesity and allergies. This will involve the investigation of new dietary strategies, the development and application of nutrigenomics and systems biology, and the study of the interactions between nutrition, physiological and psychological functions. It could lead to reformulation of processed foods, and development of novel foods and ingredients, dietetic foods and foods with nutritional and health claims. The investigation of traditional, local, and seasonal foods and diets will also be important to highlight the impact of certain foods and diets on health, and to develop integrated food guidance.

KBBE.2013.2.2-01: New technologies to study brain function in relation to eating behaviours and mental well-being

Despite progress of science it is still unclear what determines consumers to choose a food over another. Information and guidelines directed towards consumers have not achieved the targeted goal: make consumer choices healthier. Scientific evidence is lacking on the relation-ship between the life-long learning process and eating habits on the one hand and food selection and valuation on the other. The way the brain translates perceptions, emotions and knowledge into food choice, the role played by memory, vision, sensory and reward systems as well as by the sense of mental well-being are far from being clear. Understanding the underlying brain mechanisms that determine food selection and valuation is needed in order to be able to counteract them and give the correct advice to consumers thereby also preventing the onset of diet-related diseases.

This area has been difficult to address due to the dispersion of specific expertises, cost of powerful techniques and lack of harmonisation. Critical mass needs to be reached in order to allow scientists and public health professionals with insights into how to prevent clinical and non-clinical obesity in an effective and acceptable fashion.

The aim of this topic is to develop, optimise and validate new or existing tools and technologies, such as brain imaging, which would help connect the data on eating behaviour with the more 'soft' knowledge on reasons for individual consumer choice. Where appropriate, gender issues should be considered. The developed technology should give the opportunity to study obesity and weight management from a completely different perspective. It should offer a unique potential for identifying objective measures of stimuli for food intake, satiety, and even restraint of eating.

Sharing knowledge, best practices, capacities and databases should help identify synergy and create those breakthroughs and innovations needed to develop more effective nutritional interventions and genome-based dietary recommendations.

Projects supported under this topic should integrate relevant partners from Australia, Canada, New Zealand, and/or the USA. The participation of partners from those countries is essential to achieve the expected impact of the research to be undertaken.

Funding scheme: Collaborative Project (large-scale integrating project).

Additional eligibility criteria: The requested European Union contribution shall not exceed EUR 9 000 000.
Additional information: One project may be funded.
Expected impact: This topic will impact on the prevention of diet-related diseases with the ultimate goal of promoting a healthy and active population and a high quality of life, both key in delivering on the EU2020 priority of Social inclusive and healthy Europe. It is expected that the results will contribute to better dietary guidelines and advice to consumers, not least by improving the communication and education on eating habits both within and outside Europe, thereby leading to social innovation. It will support the European public health policy, such as the White Paper on Nutrition, Overweight and Obesity-related Health Issues.

KBBE.2013.2.2-02: Factors influencing the human gut microbiome and its effect on the development of diet related diseases and brain development

The species and composition of the human gut microbiome has recently been discovered as potential key factors in the development of innate and adaptive immune function, development of metabolic syndrome and obesity, and brain development and behaviour. Therefore, there is a need to define a 'healthy' gut microbiome, to better understand its ability to absorb and metabolise macronutrients, to influence energy expenditure and its role in the brain development. The effects of diet, age, physical activity and other lifestyle factors on the human gut microbiome and its effects on the development of metabolic syndrome and obesity, as well as brain development and behaviour should be studied. The specific species of the human gut microbiome predicting metabolic syndrome, obesity and other co-morbidities, and influencing the regulation of developmental programming of the brain should be identified. A multidisciplinary approach involving genetic, epigenetic, metagenomic, metabolomic, microbiological, physiological, nutritional, immunological expertise is necessary to gain insight into factors influencing the effects of human gut microbiota on the metabolism. Appropriate epidemiological studies are needed to clearly demonstrate the effect of the different factors. Use of existing data/studies on human gut microbiome is encouraged. Where appropriate, gender issues should be considered. The consortium is encouraged to comply with the International Human Microbiome Consortium principles.
Projects supported under this topic should integrate relevant partners from Australia, Canada, New Zealand, and/or the USA. The participation of partners from these countries is essential to achieve the expected impact of the research to be undertaken.
Funding scheme: Collaborative Project (large-scale integrating project).
Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
Additional information:

- One project may be funded.
- In recognition of the opening of NIH programmes to Europeans researchers, participants established in the United States of America are eligible to participate and to be funded.
- This call is implemented jointly by Theme 1 Health and Theme 2 Food, Agriculture and fisheries, and Biotechnology. Additional topics are presented in Section x [*to be adapted*] of the Theme 1 Health. During the negotiation, if added value can be demonstrated by collaboration between the selected projects, the interconnections and interfaces between these projects but also with other projects in the field will be discussed to optimise the co-operation between selected projects and to ensure the optimum of synergies**.**

Expected impact: Increase the knowledge of the human gut microbiome. This will contribute to the development of new approaches for the prevention of metabolic syndrome, obesity and metabolic impairment of brain and other organs by reshaping the gut microbiome through

lifestyle interventions, replacement therapies, development of pro and prebiotics and innovative personalised products. This topic will impact on the prevention of diet-related diseases with the ultimate goal of promoting a healthy and active population and a high quality of life, both key in delivering on the EU2020 priority of Social inclusive and healthy Europe. The European added value lies in the fact that the expected results would be of benefits to European citizens, as they will help to inform new strategy in public health and contribute to the development of new scientific data to support the legislation on health and nutrition claims. This will increase the competitiveness of European food industry.

Area 2.2.3 Food processing

Optimising innovation in the European food industry through the integration of advanced technologies into traditional food production including fermented food, tailored process technologies to enhance the functionality, quality and nutritional value of food including organoleptic aspects in food production including new foodstuffs. Development and demonstration of high-tech, eco-efficient processing and packaging systems, smart control applications and more efficient valorisation and management of by-products, wastes, water and energy. New research will also develop sustainable and novel technologies for animal feed, including safe feed processing formulations and for feed quality control.

KBBE.2013.2.3-01: Development and industrial application of sensors for food processing operations

The aim of this topic is to develop versatile and affordable sensors to be applied for the quantitative, real-time, on-line or in-line control[1] of critical quality and performance attributes for raw and in-process materials during thermal and non-thermal unit operations in food processing in the context of Process Analytical Technology (PAT). The developed rapid, sensitive and easily cleanable sensors should ensure both food quality and safety, be integrable in systematic preventive approaches such as Hazard Analysis and Critical Control Point (HACCP), and serve as elements of practical decision-making tools and early warning system. They should be auto-adaptive, quickly operative to any product or condition, and robust with respect to the variability of raw materials and line operators. Dissemination to the food industry and demonstration activities at the level of the food industry will be required to fill the gap between the developed concepts and their practical implementation.

Funding scheme: Collaborative Project (small or medium-scale focused research project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 3 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 20 % or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: Up to two projects may be funded.

Expected impact: The topic supports the competitiveness of the European processing industries and increases the number of patents in the area. Additionally, it contributes to a

[1] Definitions of these classes are as follows: in-line, the sample interface is located in the process stream; on-line, automated sampling and sample transfer to an automated analyzer; at-line, manual sampling with local transport to analyzer located in the manufacturing area; off-line, manual sampling with transport to a remote or centralized laboratory. (Beebe K et al. (1993). Process analytical chemistry. Anal Chem. 1993;65:199R-216R. Cited in: Rantanen J et al. (2001). Process Analysis of Fluidized Bed Granulation. AAPS PharmSciTech. 2001; 2(4): art. 21)

reduction of food waste, through a more efficient control of the processes. The results of research in this topic will be of interest and potential benefit to SMEs in the IT, equipment and the food industry; a strong participation of SMEs in the project itself will help contribute to the realisation of that benefit. The European added value lies in the need of finding critical mass for multilateral efforts by all players mentioned above.

KBBE.2013.2.3-02: Network for the transfer of knowledge on traditional foods to SMEs

The objectives are: (1) knowledge transfer and exploitation of research results in traditional foods to SMEs; (2) development of a strategic RTD and innovation agenda for traditional foods; and (3) fostering entrepreneurship. SMEs producing traditional food products usually have little own capability for research and innovation, and they seldom possess the financial and human resources needed to participate in collaborative projects with universities or research centres.

Firstly, with a view to improving the European food processing innovation climate, the aim of this topic is to establish and/or support a network of technology transfer centres that transfer innovative knowledge to SMEs or among existing SME programmes, clusters or associations. The network will initiate and facilitate collaborations for the development or improvement of sustainable and innovative processes and technologies with the objective of improving the quality and safety as well as the environmental performance of traditional food products of SMEs to satisfy the expectations of European consumers, alongside with establishing a transparent and sustainable supply chain. The network will help protect the intellectual property rights of the SMEs, and support their product development strategies and competitiveness. The network should be composed of several sub-networks, each of them having a limited focus, for example a region, a language, a food and/or a food group, a specifically defined production system, innovative and fair distribution concepts, in order to address directly the SMEs aimed at.

A second task for the network is to come up, where necessary, with a strategic research agenda for traditional foods that is based on specific food groups and responds to the needs of all stakeholders.

As a third task, the topic addresses stimulation of innovation and entrepreneurship among food researchers, commercial uptake of food R&D results, and entrepreneurial networking. Training modules and programmes for food researchers will be developed, translated into a variety of languages and executed. The proposed action will also create a European network of researchers, technology transfer experts and entrepreneurs in the food sector.

By extending the field of activity of the European Innovation Partnership (EIP) 'Agricultural Productivity and Sustainability' into food processing, and in close collaboration with it, the network will make use of concrete innovative actions and entrepreneurship training programmes at local, regional or national level, which are funded by Rural Development programmes of the CAP or by local, regional or national initiatives. The funds of the network will mainly be used to fund actions at cross-regional, cross-border, or EU-level.

Funding scheme: Coordination and Support Action (supporting action).

Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 5 000 000.

Additional information: One project may be funded.

Expected impact: The project results will be of interest and potential benefit to the SMEs and other market participants that are members of the network or collaborate with it. The actions will facilitate an effective transfer of innovations to and between stakeholders involved in the traditional agri-food business to maintain and increase the competitiveness of the agri-food sector, in particular of SMEs, in an increasingly global European market. Europe-wide, the

entrepreneurship training part will make an important impact on entrepreneurship by addressing innovation skills gaps, and on capacity building through the generation of motivated and knowledgeable entrepreneurs in the food sector. The high European added value of this action lies in its support to the EU Innovation Union through knowledge upgrading and sharing, contribution to a socially inclusive and healthy Europe, and development of sustainable collective governance approaches at local, regional, and national levels. The challenge is pan-European and clearly goes beyond national interests. Projects supported under this topic should lead to a greater integration of research actors and activities from across the European Union, and the candidate countries.

Area 2.2.4 Food quality and safety

Assuring chemical and micro-biological safety and improving quality in the European food supply. This will include understanding the links between microbial ecology and food safety; developing methods and models addressing the integrity of the food supply chains; new detection methods, traceability and its further development, technologies and tools for risk assessment, including emerging risks, management, and communication, as well as enhancing the understanding of risk perception. This will also include science based methods for risk benchmarking in the field of food safety.

KBBE.2013.2.4-01: Assuring quality and authenticity in the food chain

Globalisation and the growing complexity of the food chain, as well as recent food scares, have raised consumer awareness regarding the quality and authenticity of the food they consume. The term 'food authenticity' refers to whether food purchased by consumers matches its description, e.g. declaration of specific quality attributes in high value products, origin (geographical, botanical, species, production method, organic foods), process practices (e.g. irradiation, freezing), certification and compliance with the established (legislative) quality standards. European consumers are prepared to pay extra for added value foods and are increasingly demanding understandable and reliable information on food labels. These trends have stressed the need for harmonisation of food standards and development of accurate tools to verify and assure that foods match their description and detect fraud. The main objective of the topic is to determine the current state-of-the-art, centralise and share existing data, identify gaps, prioritise research needs and subsequently coordinate research activities in the area of food quality and authenticity assurance by means of launching competitive calls. These research activities may include providing reference materials and databases; conducting feasibility studies; identifying markers to characterise the quality and/or authenticity of foods (or their potential adulterants); development, validation and standardisation of verification methods; understanding consumer concerns, attitudes and perceptions towards food authenticity and promoting dissemination of results and technology transfer.

Funding scheme: Collaborative Project (large-scale integrating project).

Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.

Additional information: One project may be funded.

Expected impact: The European added value lies in offering authentic, high-quality food to consumers, as well as in strengthening the competitiveness of European food producers by enabling them the add value to their products. The expected project results will help food producers to better communicate the qualities, characteristics and attributes of the different food commodities. In addition, determining the authenticity of foods can reduce trading blocks and prevent fraud in terms of false description, substitution of cheaper ingredients and adulteration, as well as incorrect origin labelling. This will allow consumers to make informed

choices and restore consumer confidence. The research activities launched within the project should clearly support EU policies on agricultural product quality, marketing standards and food information to consumers.

Area 2.2.5 Environmental impacts and total food chain

Protecting both human health and the environment through a better understanding of the environmental impact on and from food/feed chains. This will involve study of food contaminants and health outcomes, monitoring of environmental effects, developing enhanced tools and methods for the assessment and management of impacts on, and resistance of, food and feed chains to global changes, in particular to the environment. Assuring quality and the integrity of the food chain requires new models for commodity chain analysis and total food chain management concepts, including consumer aspects.

KBBE.2013.2.5-01: Assessment of the impact of global drivers of change on Europe's food security

The aim of this topic is to obtain a comprehensive picture of the effects of the global drivers of change (climate, economic concentration and market structure, financial power, resource competition, marginalisation, property rules, geo-political shifts, consumer preferences ...) on European and global food demand and production and consequently food flows. Research will focus on the vulnerability of present European food systems in a context of socio-economic, institutional and agro-ecological change and look into the new challenges and opportunities that the food sector will face in future. Methodologies for vulnerability assessment, improved food security and dynamic modelling tools for determining the sustainability frontiers of different food production systems under newly prevailing conditions will be reviewed, upgraded and/or developed. Following the analysis relevant scenarios will be elaborated for desired food supply chain developments. Research activities will address the major societal risks associated with globalisation as a means of predicting change, provide insight into conflict prevention and resolution and orient policy making. Recommendations to warrant Europe's medium- and long-term food security situation will be formulated for EU policy makers with a view to promote social innovation and stability in Europe and its partner regions.

Funding scheme: Collaborative Project (small or medium-scale focused research project).

Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 4 000 000 per proposal.

Additional information: One project may be funded.

Expected impact: The European added value of this topic is its potential for an integrated approach, dealing with the total food system from consumers to ecosystems in a single conceptual framework, while addressing all the actors of the systems, either in their individual dimension and/or in their interactions. This innovative approach has the capacity to correct the currently dysfunctional food system characterised by relatively high numbers of people who are malnourished, micronutrient deficient and overweight through a better understanding of the interdependence of production, trade, stocks, the unpreparedness to meet the vagaries of the weather and the needed incentives to come to a food system that is more equitable, healthy and sustainable. Research will draw attention to the direction in which innovation has to be channelled in order to arrive at desired innovation in food consumption patterns and behaviour, business models, legal frameworks and in the role and management of real grain stock reserves and ways to mobilise these in times of need.

KBBE.2013.2.5-02: Saving water and energy for eco-efficient food processing

The aim of the topic is to significantly and simultaneously save water and energy[2] throughout the entire post-harvest chain from the supply of raw ingredients to processing (operations and cleaning), packaging, warehousing, distribution, retail and household handling of food commodities. A number of optimised, emerging and novel food production and storage technologies, equipment and/or logistics should be developed for environmentally-benign, water- and energy-efficient and consumer-friendly manufacturing and handling of a wide range of foods, whilst improving or at least maintaining food quality and safety. For that purpose, a diagnosis of water and energy consumption of the food processing and the whole food chain has to be performed. This involves also process simulation and modelling as well as an environmental, social and economic process life-cycle assessment in line with the International Reference Life Cycle Data System (ILCD) Handbook. Dissemination to the food industry and demonstration activities at food industry level will be required to fill the gap between the developed concepts and their practical implementation.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 20 % or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: Up to two projects may be funded.

Expected impact: The European added value lies in an innovation-driven increase in the competitiveness of food producers and food equipment manufacturers, in particular SMEs, while reconciling sustainability imperatives. Involving SMEs in the project itself will help contribute to achieving these societal objectives. The research will lead to notable reductions in water and energy consumption while at the same time assuring sustainable economic growth. The research contributes to reaching the objective of a resilient sustainable and productive food chain as planned to be published in the 'European Strategy and Action plan for a sustainable bio-based economy by 2020'. Besides, it also contributes to reaching the specific resource efficiency objectives for 2020 and beyond as planned to be published in the 'Roadmap for a resource-efficient Europe', which is a key part of 'A resource-efficient Europe – Flagship initiative of the Europe 2020 Strategy'. Both aim to help transform Europe into a knowledge-based, resource-efficient economy.

[2] For the scope of this topic, the term ‘energy saving’ is used as in the communication *Energy Efficiency Plan 2011*, which says that "Technically, 'energy efficiency' means using less energy inputs while maintaining an equivalent level of economic activity or service; 'energy saving' is a broader concept that also includes consumption reduction through behaviour change or decreased economic activity. In practice the two are difficult to disentangle and – as in this Communication – the terms are often used interchangeably."

KBBE.2013.2.5-04: Development of inclusive and sustainable rural-urban interfaces through regional foodscapes and socially innovative strategies[3]

As urbanisation progresses, we are increasingly losing agricultural land. At the same time, there is a growing interest from consumers in urban areas to have access to fresh, locally produced and healthy food. Food supplies are not evenly distributed in many cities, leading to food-rich and food-poor areas with effects on obesity rates, health and well-being. Small local farm holdings in the peri-urban areas are increasingly struggling to stay in business and at the same time there are problems of high urban unemployment and crime. Over recent years a number of cities around the world have started to set up innovative programmes to help address these issues and facilitate the supply of locally produced fresh food into urban areas. Some of these initiatives are having far-reaching benefits on local society, the economy, the environment, health and well-being. Examples include innovative strategies for city market gardens, green roofs, urban aquaculture, community gardens and the setting-up of urban farm colleges. Innovative youth involvement and training programmes are providing new skill development opportunities, covering fields as diverse as small-scale farming, environmental protection, catering, nutrition, transport, soil protection etc. New business opportunities for SME start-ups are generated in, for example, the new catering, training, supply and distribution networks created. Food waste and energy consumption are reduced and there is evidence of significant positive effects on social inclusion, cohesion and well-being.

The project will look at a range of current programmes with a view to establishing best-practice scenarios and developing new, socially innovative strategies that go beyond traditional foodscape analyses to address broader socio-economic and cultural factors, taking a holistic approach. The project will help develop innovative approaches to facilitate the supply of fresh, healthy, local food to consumers, the catering industry and to the public sector (e.g. hospitals, schools, care homes etc.) while reducing transport and packaging costs and wastage. Ways of promoting local, urban food production through adaptive governance should be explored (e.g. green roof design, aquaculture, city community gardens and city composting programmes). The sociological, cultural and economic impacts of locally grown food systems on social inclusion, skill development and food security will be evaluated together with the potential benefits of youth engagement and community development programmes linked to urban and peri-urban agricultural initiatives, taking account of the social, demographic, economic, policy, and ecological aspects. The project will analyse and develop sustainable models for rural-urban interfaces that include assessment of mitigation of climate change, Life Cycle Assessments and consumer preferences. Institutional and logistical governance, including for example community supported local agriculture and urban farming programmes, will also be evaluated. Innovative strategies for public actors, caterers, policy makers, local communities, local farmers, architects, city planners and SMEs will be developed. Ways of stimulating consumer and community engagement will be explored together with integrative land use strategies and a careful analysis of the potential barriers, environmental impacts and potential externalities.

Funding scheme: Collaborative Project (small or medium-scale focused research project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 4 000 000 per proposal.

[3] A complementary topic on "Post-carbon cities" is expected to be open in Theme 4 Socio-Economic Sciences and Humanities (under topic identifier SSH.2013.x.x-x). That topic would deal with qualitative scenarios on the future of EU cities; quantification of urban trends (demography, economic development, social behaviour) in EU cities; new ways of implementing sustainable ways of living in EU cities; the potential role for exporting EU urban best-practices in emerging countries.

- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 25% or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: One project may be funded.
Expected impact: The project will provide stakeholders with a range of socially innovative strategies and in-depth socio-economic and socio-cultural insights for ensuring the provision of fresh, healthy, locally produced food to urban and inner cities while tackling social exclusion and youth unemployment and positively re-structuring the rural urban interface

KBBE.2013.2.6-01: Exploitation of Framework Programme project results in food, health and well-being by small and medium-sized enterprises

The aim of this topic is to allow SMEs to take up research outcomes resulting from earlier FP funding in food, health and well-being. The follow-up project should turn available scientific and technological knowledge into innovative processes, products or services, thereby clearly going beyond the earlier project(s). It will involve a demonstration phase and/or a proof-of-concept, a business plan, and an environmental, social and economic life-cycle assessment in line with the International Reference Life Cycle Data System (ILCD) Handbook (if applicable). The application must show that the knowledge has been generated earlier and that the results have already been achieved and are available for further research and development – mere 'expected results' are not acceptable as a basis for project selection. Although the principal research must have been carried out in earlier project(s), further research and development must remain central to the project and will allow SMEs to get nearer to actual application.
Funding scheme: Collaborative Project (small or medium-scale focused research project targeted to SMEs)
Additional eligibility criteria:

- SME-targeted Collaborative Projects will only be selected for funding on condition that the estimated EU contribution going to SME(s) is 75% or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.
- The maximum duration of a project is two years.

Additional information: The topic aims at financing a limited number of small or medium-scale focused research projects targeted to SMEs with an overall maximum budget of EUR 10 000 000.
Expected impact: This approach gives more attention to the innovation phase. As well as improving the impact of an earlier project, it will improve the S&T capabilities, the innovation potential and the competitiveness of the SMEs taking part. The European added value lies mainly in a leverage effect on private investment, the cooperation of private companies with foreign partners on a scale not possible at national level, and the reduction of commercial risk by making existing research results applicable across Europe and beyond.

Activity 2.3: Life Sciences, biotechnology and biochemistry for sustainable non-food products and processes

- *Strengthening the knowledge base and developing advanced technologies for terrestrial or marine bio-mass production for applications in industrial processes and in energy production. This will include plant, animal and microbial genomics and metabolomics to improve the productivity and composition of raw materials and bio-mass feedstocks for optimised conversion to high added-value products including biological resources utilisable in pharmaceutical industry and medicine, while exploiting natural or enhanced terrestrial and aquatic organisms as novel sources. This will fully incorporate life cycle analysis of bio-mass production practices, transportation, and storage and market deployment of bio-products.*

- *Addressing the application of industrial bio-technologies within whole crop and forest bio-mass chains to realise the full potential of the bio-refinery approach (e.g. green chemicals), including socioeconomic, agronomic, and ecological and consumer aspects. This will be enhanced by an increased understanding and control of plant and microbial metabolism at the cellular and sub-cellular level, and how this is integrated into whole system performance in the production of high value commodities deploying bio-processes with increased yield, quality and purity of conversion products, including bio-catalytic process design.*

- *Using or developing bio-technologies for novel and improved high quality, high added-value and renewable forest based products and processes to increase sustainability of wood and wood production, including timber, renewable materials and bio-energy stocks.*

- *Addressing the potential of biotechnology to detect, monitor, prevent, treat and remove pollution.*

- *Maximising the economic value of waste and by-products through new and potentially energy-saving bio-processes, alone or in combination with plant systems and/or chemical catalysts.*

Support for demonstrating the potential of biotechnological applications

Europe stands strong in producing world-class research but lags behind its main competitors in innovation and commercial exploitation. Enhancing the patent system in Europe, facilitating technology transfer and improving access to finance could facilitate bringing scientific breakthroughs to the market place. This demonstration action will address some of these issues by providing support for bringing research results closer to market, thus enhancing the economic impact of the Biotechnology programme.

The demonstration action will introduce a real innovation focus by promoting the exploitation of results and offering seamless support to the industry and in particular SMEs. The demonstration activities will address technical and economic feasibility issues that will accelerate market introduction of the innovative products and services.

The demonstration action is bottom up, with the specific scope of the proposal defined by the participants. Proposals should nevertheless fit within the 'Life sciences, bio-technology and bio-chemistry for sustainable non-food products and processes'-activity described in the specific Cooperation programme[4]. The action is primarily aimed at industrial participants who should take the lead in the demonstration phase with research or academic organisations in a possible supporting role. The projects need to have a clear link with the preceding research

[4] *2006/971/EC: Council Decision of 19 December 2006 concerning the Specific Programme Cooperation implementing the Seventh Framework Programme of the European Community for research, technological development and demonstration activities (2007 to 2013).*

phase. Activities can include testing of product-like prototypes, scale-up studies, performance verification and implementation of new technical and non-technical solutions. However, the demonstration projects are not meant for further research and development activities. Projects can rely on existing demonstration plants or infrastructure but should not include the construction of new ones. Proposals should also include detailed market studies/business plans or market strategies.

Funding scheme: Collaborative Projects

Additional information: This topic represents a major effort to support innovation in the Biotechnology sector, enhance competitiveness of the European biotechnology industries and provide a considerable effort to the European Bio-economy. The topic aims at financing a limited number of small to large collaborative projects within an overall maximum budget of EUR 20 000 000. The EU contribution to the project is restricted to demonstration activities, other activities and management.

Expected impact: Projects under the scheme for demonstration aim at bridging the gap between research and market, while keeping a pre-competitive nature. The concept is to prove the techno-economic viability of a new solution (itself an outcome of a successful research project) that offers a potential economic advantage, but which cannot be directly commercialised.

The expected impact should be clearly described both at qualitative and quantitative level, providing an indication of the expected economic impact, e.g. on turnover, employment or target markets as well as expected patent applications or licence agreements, creation of spin-off companies, etc.

Through this demonstration action, commercial companies, especially SMEs, will be able to receive seamless support for the further development of successful research results. This should help prepare and facilitate market introduction of scientific breakthroughs. This is particularly relevant in the field of biotechnology where the timelines for technology maturation can be extended. Projects ensure to respect basic ethical principles and include provisions for communication and dissemination of results.

Bioeconomy and bioregions

The bioeconomy can significantly contribute to the future development of rural, coastal and industrialised regions by improving the sustainable exploitation of their natural and industrial resources, for example by creating supply chains for residues and waste as feedstock for bio-based industries, or the setting up of networks of biorefineries.

The objective of this topic is to develop region-specific bioeconomy strategies based on a socio-economic, environmental and technological assessment of the bioeconomy potential of the different regions in Europe (at sub-and supranational level in Europe). To achieve this, the project will 1) develop criteria to describe the regions in terms of their bioeconomy potential (e.g. based on geographical location, climate, predominance of bioeconomy sectors, bioclusters, existing skills, resources and technologies, etc); 2) compile a catalogue of instruments and measures (ranging from education, research and innovation to infrastructure) that can be correlated against the criteria and will foster the development of regional bioeconomies; and 3) prepare regional profiles based on the developed criteria that will describe the state-of-play of the bioeconomy in the selected regions and propose instruments and measures to improve the exploitation of this potential.

The project will liaise with local, regional and national authorities and relevant stakeholders (e.g. bioclusters) to establish the regional profiles. It will create a network structure that will

encourage the exchange of best practices and the creation of synergies between regions. As such, it will also contribute to the development of smart specialisation strategies of regions in accordance with the new European cohesion policy.

The activities of the project will take into account existing FP7 and CIP projects and other initiatives supporting the bioeconomy at regional and national level.

Funding Scheme: Coordination and Support Action (supporting action).

Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 1 000 000 per proposal.

Additional information: Up to one project may be funded.

Expected impact: The project will allow regions to recognise their bioeconomy potential and assist them in formulating clear targets to promote their local bioeconomy and in creating a favourable environment to attract public and private investment. The project will contribute to implementing the objectives of several European policy initiatives, such as the Bioeconomy Strategy, Innovation Union, the eco-innovation initiatives of the Environmental Technologies Action Plan, the Roadmap to a Resource-Efficient Europe, the CFP and the CAP.

Area 2.3.1 Novel sources of biomass and bioproducts

The production of bio-mass in terrestrial environments is of greatest importance for the development of the KBBE as this will deliver feedstocks and precursors for nearly all bio-industries or directly saleable end-products.
Research and development activities will foster the optimisation of these biomasses for industrial purposes. It will generate knowledge in metabolic control, pathway design, metabolic engineering in plants, animals and other organisms (such as fungi)[5], and domestication and breeding, also improving agricultural traits. Novelty will rely to some extent on screening of terrestrial biodiversity and discovery of new organisms and new biochemical pathways. The development and optimisation of novel expression systems in terrestrial organisms will eventually lead to new products and practices.

Plant High Value Products - from discovery to final product

The terrestrial plant biodiversity remains an untapped source of natural bioactive molecules of importance for various industrial applications, such as high value agro-chemicals, pharmaceuticals, biomaterials, cosmetics, etc. Their efficient utilization requires an integrated and comprehensive effort from the stage of biodiscovery, including plant bioprospecting, through identification of small bioactive compounds, then to optimized domestication and cultivation strategies for selected plant species or ecotypes, metabolic engineering of the selected biochemical pathways to improving the productivity and finally to product development and commercialisation.

The projects will engage in a full chain of research and innovation needed to bring to market new or improved products aiming at innovative methodologies in order to tackle the existing bottlenecks and addressing the needs of the bio-industry. The focus is on the efficient exploitation of the novel bioactivities, especially in case of unusual and/or under utilised plant species/ecotypes. This includes sustainable access to raw material, particularly in case of plants that are endangered, protected or difficult to collect and cultivate, and improvements in

5 However, the focus will be on plant and animal biotechnology. Microbial biotechnology will be mainly covered in Areas 2.3.3 and 2.3.5.

technical aspects of the metabolic engineering pipeline (e.g. isolation of sufficient quantities of the biomolecules, their purification and sustainable production either *in planta*, or by alternative routes in other suitable biological systems).

The plant species to be targeted can include European and/or non-European e.g. medicinal or aromatic plants, either cultivated or collected from the wild. The full use of the residual plant biomass should be explored in a cascade biorefinery approach. The projects are to be industry-driven and will include demonstration activities to prove the techno-economic feasibility and effectiveness of production and extraction systems. Downstream processing and separation aspects will form an integral part of the projects. Economic and regulatory issues must also be taken into account both in respect of conditions found in Europe and outside of Europe. The projects must adhere to relevant international legislation on sustainable use and equitable sharing of biological resources. Dissemination and training activities (e.g. summer schools, press releases, open days) will form an essential part of the projects.

Funding scheme: Collaborative Project (large scale integrating project targeted to SMEs)

Additional eligibility criterion: SME-targeted collaborative projects will be only selected for funding on the condition that the EU contribution going to SME(s) is 25% of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before the signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: This topic represents a major effort to support innovation in the European Plant and Biorefinery sectors, enhance competitiveness of the European biotechnology industries and provide a considerable effort to the European Bio-economy. The topic aims at financing a limited number of large collaborative projects within an overall maximum budget of EUR 20 000 000.

Expected impact: The projects will advance the sustainable use of terrestrial plant biodiversity. Their European Added Value will lay in the development of novel plant-based 'eco-friendly' products with bioactive properties, especially in pharmaceutical, cosmetic or agrochemical sectors, leading to significant environmental and economic benefits for the society at large. The products developed will be advantageous to the consumers by being cheaper, more readily accessible and more environmentally friendly compared to the existing alternatives. The projects will strengthen the competitiveness of European plant biotechnology industry, as well as increase competition in research and innovation. This topic is particularly well suited for an active engagement of International Cooperation Partner Countries. Their involvement should strengthen the expected impact of the research to be undertaken. This will be assessed at the evaluation. The projects funded should be complementary and reinforce related on-going FP7 KBBE projects on the plant biotechnology. It is expected that the projects will anticipate future trends and consumer demands with a strong focus towards the market and product commercialisation.

EU-Latin America Partnering Initiative on sustainable biodiversity in agriculture

The biodiversity preservation in agricultural systems is vital not only for the environmental protection but also for the sustainable development of the European and global bio-economy. The project developed under this topic will contribute to identifying promising crops, their conservation/domestication, and to exploring opportunities for the sustainable commercial use of the natural biological resources in agriculture. The project will have a dual aim: first

identifying and linking existing agricultural resource collections (e.g. plant germplasm banks, botanical gardens), as a network to facilitate transfer of knowledge and technology between the stakeholders, in order to lessen environmental pressure on endangered or protected plant species, and second, identifying among them suitable resources, which could be subsequently used in a sustainable way for the commercial development of the bioeconomy concept. The second aim should target in particular novel or underutilised agricultural plants. The participation of the International Cooperation Partner Countries, especially from Latin America is seen as critical in the project and is especially encouraged. The project will develop efficient communication and dissemination tools (e.g. a website, conferences, activities aimed at general public, summer schools etc), engaging in dialogue with relevant stakeholders (international policy makers, NGOs, etc), to contribute to the dual aims, and will ensure a long lasting impact of the project. The project must fully adhere to relevant international legislation on sustainable use and equitable sharing of biological resources. The project should take stock of the related past and on-going projects and to complement them in an integrative approach.

Funding scheme: Coordination and Support Action (coordinating action)

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 1 000 000 per proposal.
- Minimum number of participants: 3 from different Member States or Associated countries and 3 from different ICPC from Latin America.

Additional information: Up to one project may be funded. Participants from Latin American countries in a Science and Technology agreement[6] with the European Union will support their participants to the project. Participants from other Latin American ICPC countries could be funded by the EU. The cooperation with complementary actions should be reflected in the proposal. This will be considered in the evaluation.

Impact: The topic addresses two issues with high societal relevance and of public concern: improved global efforts for biodiversity protection in agriculture, and the sustainable use of the natural biological resources, especially for the benefit of the local communities and family farmers. The project will raise public awareness on plant biodiversity preservation in agriculture and will support a structured global environment for cooperation between relevant stakeholders in this area. The effectiveness and long-term impact of the project will be ensured by including complementary European and global participation.

Area 2.3.2 Marine and fresh water biotechnology (Blue biotechnology)

The economic and scientific potentials of aquatic environments (principally marine but including freshwater also) remain insufficiently explored using the power that modern biotechnology provides. Moreover, their resources remain largely untapped by European industry. Extreme or specific environmental conditions (e.g. in temperature, pressure, salt content, pH, chemical composition) and the enormous biodiversity of these ecosystems offer multiple opportunities for bio-prospecting, exploitation and use of microbes (e.g. cyanobacteria, fungi), plants (micro- and macro-algae) and animals (e.g. fish, molluscs, sponges) and their physiological performance and genes. This can lead to novel products or

[6] The European Union has Science and Technology agreements with the following Latin American countries: Argentina, Brazil, Chile and Mexico. Conacyt (National Council of Science and Technology) for Mexico and Embrapa (Brazilian Enterprise for Agricultural Research) for Brazil are main interlocutors of the EU in this context and intend to support and/or carry out mirroring and complementary actions.

sources for industrial applications (e.g. bio-processing, biomass, bio-energy, bio-materials, specialty chemicals, pharmaceuticals, and aquaculture) and beyond.

Marine biotechnology ERA-NET

Cooperation between European research funding bodies in the area of Marine Biotechnology started in FP7 under the umbrella of the KBBE-NET high-level group and continues within the ERA-NET Preparatory Action which is providing a successful forum for the exchange of information, and has initiated the process of identifying complementarities between the research funding bodies, thus creating a basis for developing future joint, transnational calls. The proposed network of European research funding bodies in the area of Marine biotechnology will thus build upon these previous initiatives and will capitalise on its achievement, such us, the analysis of the current landscape in Europe and beyond, the mobilisation of key stakeholders as well as the set up of initial cooperation tools to develop joint programmes and pool resources for collaborative research at European scale.

The overall aim of this ERA-NET is to further increase the level of coordination between European research funding bodies in the area of Marine Biotechnology, seeking complementarities between national activities and pooling resources to undertake joint funding of transnational projects.

Research collaborations shall serve to tackle scientific and industrial challenges to establish Europe as a world leader in marine bio-screening and derived bio-products and to better integrate and rationalise existing infrastructures and databases. These collaborations will address the important role of marine biotechnology for the development of related industries.

The network must seek to expand the previous ERA-NET preparatory action membership to include new funding bodies from other Member States and Associated Countries. In setting priorities for the network's activities it is important that complementarity with other FP7 initiatives is sought and that interactions are established with related ERA-NETs and ETPs across the marine and relevant sectors. It is expected that the opportunity for future global initiatives in the area of marine biotechnology will also be analysed.

Funding scheme: Coordination and Support Action (coordinating action).

Additional eligibility criteria: The requested European Union contribution shall not exceed EUR 2 000 000 per proposal.

Additional information: Up to one project may be funded.

Expected impact: The project supported under this topic should lead to a greater integration of research actors and activities from across the enlarged European Union, and the candidate countries. It is expected that the proposal will consolidate the basis for further coordination efforts in the area of Marine Biotechnology; seek for complementarities between national activities, and start pooling resources for funding and implementing future research activities in a synergistic manner. Ultimately, the cooperation shall lead to a self-sustainable and long lasting network of programme managers in the area of marine biotechnology, enabling the translation of information gained from innovative fundamental research into social, environmental, geographical and economic benefits. The European added value lies in supporting and enhancing the ERA in the field of marine biotechnology.

Innovative antifouling materials for maritime applications[7]

Biofouling at the interface with seawater is a major concern for mobile and stationary maritime structures and equipments. Biofouling negatively affects the hydrodynamics of ships, it increases drag by accumulating on the hulls and reduces the efficiency of propulsors, resulting in higher fuel consumption. In the case of mobile equipment biofouling can also act as marine pest vector. For stationary structures, such as those linked to aquaculture, biofouling generates a need for regular cleaning and regeneration, which is costly, might disrupt operations and is potentially polluting. Since the banning of Tributyltin (TBT), a highly toxic biocide used in antifouling coatings, and due to increasing concerns on the use of heavy metals to control biofouling in the marine environment, alternative cost-efficient and environmentally friendly approaches are needed.

The proposals under this topic should focus on developing new, well beyond the state of the art, non synthetic biocide or heavy metal based antifouling materials and should address in an integrative way, both mobile as well as stationary maritime applications.

On the basis of a thorough analysis of the state of the art, research could draw on the whole range of antifouling materials e.g. foul release approach, biomimetics, marine biotechnology based coatings etc. The issues of supply and the need for the biobased active antifouling compounds to be produced in bulk, as required for final commercial production should be given due consideration. The proposals should include bench marking of related existing materials and technologies. In this sense, environmental and economic factors, as well as performance, must be duly considered.

An improvement in the understanding of marine biofouling processes with respect of the developed material is encouraged and should be an integral part of the proposals.

The proposals should include relevant field testing for all the selected applications. Development, improvement and/or standardisation of relevant protocols should be included. Proof of concept in terms of product and/or process should be delivered within the project, excluding commercially usable prototypes (2006/C323/01 2.2g), but convincingly proving scalability towards industrial needs.

The proposals should follow a life cycle approach for the new materials and their selected applications also taking into account issues of cost efficiency, effective life span, production, handling, maintenance, environmental impact, ecotoxicological profile and end of life. The proposals may include Life Cycle Assessment. The proposals should include assessment of the environmental, health and toxicological effects according to REACH (http://echa.europa.eu/), OECD Guidelines for the Testing of Chemicals (http://www.oecd.org) and/or relevant international standards.

To ensure both due dissemination and future exploitation of foreground it is important that the proposals include end-user industry and/or associations

Funding Scheme: Collaborative Projects (large-scale integrating project).

Additional information: Number of projects to be financed (under discussion).

Expected impact: Outcomes of the research will facilitate the development of new and better performance functional materials for marine antifouling, leading to improved marine environmental impact and decreased need for maintenance of both transport as well as

[7] The topic will be an integral part of the joint initiative "The Ocean of Tomorrow". Joint effort between Themes "KBBE", "NMP" and "Transport". The contribution of KBBE's Activity 2.3 is 5 million Euros.

stationary maritime equipment. New antifouling materials development will thus enhance the competitive advantage and European industry leadership in the field of marine antifouling coatings and will have a positive impact on the Marine Waters Environmental Status. Research under this topic will also should also lead to better understanding of the scope of existing materials and technologies and allow benchmarking of the different available options.

The CO_2 algae biorefinery

Algae represent a promising alternative to convert CO_2 (e.g. from the atmosphere of capture in industrial processes) into high added-value products and biofuels. Algae biorefineries can thus alleviate food *versus* fuel conflicts and may become particularly advantageous for regions with limited biomass availability.

The topic aims at developing innovative approaches to tackle the major challenges intrinsic to the development of the algae biorefineries. The proposals under this topic should focus on the production of high value-added products such as polymers, pharmaceuticals, high value oils and chemicals, colorants, etc. The integrated production of biofuels as well as algae use in water treatment or carbon sequestration could be considered to assure the economic viability of the whole process.

Strong weight will be put on industrial leadership of the projects. They should include the development of suitable algal strains and cultivation parameters. Boundaries to this aim include algal biodiversity exploration (bioprospecting, algae species natural growing conditions), improvement of photosynthetic efficiency, customising and maximising added value products' yields and the development of algae cultivation methods adapted to mass production. Design and development of different cultivation systems with innovative and efficient configurations should also be included together with downstream processes such as harvesting, dewatering, product extraction and its integrated conversion. The proposed concepts shall demonstrate their techno-economic viability at least at (industrial) pilot scale. The overall sustainability approach will be a critical element of the project.

Funding Scheme: Collaborative Project (large-scale integrating project targeted to SMEs)

Additional eligibility criterion: SME-targeted collaborative projects will be only selected for funding on the condition that the EU contribution going to SME(s) is 25% of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before the signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: This topic represents a major effort to support innovation in the European Marine and Industrial Biotechnology sectors, enhance competitiveness of the European biotechnology industries and provide a considerable effort to the European Bio-economy. The topic aims at financing a limited number of large collaborative projects within an overall maximum budget of EUR 20 000 000.

Biosensors for real-time monitoring of biohazards and man-made chemical contaminants in the marine environment[8]

Due to growing concerns on the marine waters environmental status and the related needs to assess costal water quality, harm to natural resources and risks to the human health, there is nowadays an increasing need for real-time monitoring of marine water quality. Real-time *in situ* monitoring of marine chemical contaminants, and biohazards (e.g. toxic algae) is of utmost importance for the sustainable management of the seas and its resources such as fisheries and aquaculture. Real time detection of critical changes in the marine ecosystems caused by environmental pollutants (including emerging substances) acting individually or synergetically in multi-stressor conditions is a priority for the development of early warning systems.

Technology wise, by combining technological and biological elements in a single measurement device, marine biosensors have the potential to offer unique features for highly specific and precise measurements to respond to the growing need for accurate real time monitoring of the quality of sea water and marine ecosystems to support relevant EU legislations, in particular the Water Framework and Marine Strategy Framework Directives (WFD and MSFD).

Based on most recent knowledge on genomics and physiology as well as on materials (including nanotechnology) information technologies and relevant existing detection/monitoring technologies research under this topic should aim at developing innovative real-time, *in situ* biosensors for the detection and monitoring of high impact and presently difficult to measure analytes, such us, algal toxins, synthetic organics, herbicides/pesticides and polycyclic aromatic hydrocarbons (PAH), etc. Where possible, bioavailability and ecotoxicology should also be considered in the proposal.

The proposals should include a test phase to demonstrate the potential application of the biosensor(s) on environmental and/or aquaculture related applications. Development, improvement and/or standardisation of relevant protocols should be included. Measurement devices should show ability to compete with non real time alternatives and provide faster, less expensive, and less time-consuming measurements than the currently available instrumental analytical methods. For the most developed advancement in this area proof of concept in terms of product and/or process should be delivered within the project with convincingly proving scalability towards industrial needs.

Funding Scheme: Collaborative Project (large-scale integrating project).

Additional information: Number of projects to be funded (under discussion).

Expected impact: New biosensors in the field of environmental monitoring will facilitate the implementation of the Marine Strategy Framework Directive by enabling member States a more cost-effective monitoring and assessment of the Environmental Status of their Marine Waters and enabling for a more sustainable management and exploitation of marine resources (such as fisheries and aquaculture) and minimise risks to human health. Outcomes of the research will also contribute in the monitoring of the water quality required for shellfish farming as laid down in 2013 the Directive 2006/113/EC (which will be replaced after 2013 by the WFD and MSFD). The development of new biosensors will provide competitive advantage and European leadership for the biotechnology industry in the field of monitoring

[8] The topic will be an integral part of the joint initiative "The Ocean of Tomorrow". Joint effort between Themes "KBBE", "NMP" and "ENV". The contribution of KBBE's Activity 2.3 is 5 million Euros.

and diagnostic technologies, including improved measurement capabilities for highly specific and complex biological components.

Area 2.3.3 Industrial biotechnology: novel high added-value bio-products and bio-processes

This area will address the development and application of industrial biotechnology for the production of high-value products such as fine and speciality chemicals, antibiotics, vitamins, detergents, etc. Industrial biotechnology enables industries to deliver novel products which cannot be produced by conventional industrial methods; in addition it will make possible replacing chemical processes by more resource efficient biotechnological methods with reduced environmental impact, thereby extending and strengthening the KBBE.
Research and development will enable among others the discovery of novel enzymes and micro-organisms with novel applications, the elucidation and optimisation of their functions, improvements in concept and design of bioreactors, such as biocatalytic process design, advancing fermentation science and engineering, and improving up- and down-stream processing where relevant.

Optimal and cost-effective industrial biocatalysts

Biocatalysis offers tangible benefits over conventional processes such as cost-efficiency, reduced use of solvents and lower energy requirement. The number of biocatalytic chemical transformations carried out at industrial scale has increased rapidly in the last decades. The full potential is far from being realised and there are high prospects to expand the range of reactions catalyzed by enzymes.

The aim of the topic is to expand the number/type of chemical transformations carried out by enzymes at industrial scale. The approach involves optimising enzymatic performance for a targeted reaction and in the industrial context in which it is to be applied.

Proposals should address the discovery and/or development of specific biocatalyst(s) that seamlessly meet the requirements of the targeted industrial process. The approach will involve recovery of novel biocatalysts (e.g. from environmental metagenomes) and the development and implementation of technologies to produce biocatalysts that are suited to the rigours of the industrial environment (e.g. by the use of directed evolution, computational technologies, *in silico* enzymes design, protein or cofactor engineering, etc). Downstream processes and methods for enzyme formulation and immobilisation are also to be developed, considering innovative reactor design and configuration.

Projects will have a strong industry drive and include demonstration activities to bridge the gap between lab and industrial scale and to prove the techno-economic viability of the targeted biotransformation.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs)

Additional eligibility criteria: SME-targeted Collaborative Projects will only be selected for funding on the condition that the estimated EU contribution going to SME(s) is 25% or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: This topic represents a major effort to support innovation in the biocatalysis sector, enhance competitiveness of the European biotechnology industries and provide a considerable contribution to the Knowledge Based Bioeconomy. The topic aims at

financing a limited number of large collaborative projects with an overall maximum budget of EUR 20 000 000.

Expected impact: To move closer to industrial application those enzymatic biotransformations which are currently in a laboratory research phase. Enhancing the competitiveness and sustainability of the European biotech and chemical-using industry by the development of sustainable enzymatic biotransformation (e.g. with fewer steps, lower use of toxic reactants and solvents and efficient use of reagents). The project should contribute to the objectives of industrial and innovation policy, such as the EU Strategy for Key Enabling Technologies and the Lead Market Initiative on Bio-based products.

Opening markets for bio-based products: Standardisation, labelling and procurement

Bio-based products create entirely new markets or enter markets dominated by well-established petro-chemical products. Regulatory instruments like standards and labels can significantly contribute to the uptake of bio-based products in consumer markets and in public procurement. The objective of this topic is to:

- Develop standard test methods and test data for generally applicable European standards on functionalities of and standard sustainability criteria for bio-based products that are compatible with previous work on standardisation, e.g. on the determination of bio-based content (carbon and biomass), product functionalities and biodegradability. As a minimum, these standards need to be developed for biopolymers, -lubricants, -surfactants and -solvents.
- Assess the suitability of the Ecolabel criteria for bio-based products, in view of possibly creating a dedicated product group and further developing and improving the Ecolabel criteria for bio-based products in accordance with the developed standards on functionality and sustainability criteria.
- Coordinate the creation of an initial European product information list for bio-based products that will contribute to enabling public procurement for bio-based products and promote their uptake in consumer markets

The proposal must ensure a link with the activities of the European Committee for Standardisation (CEN) concerning bio-based products and take into consideration related standardisation mandates (already issued and in process) and existing national and EU-funded projects. The proposal should explore possibilities for harmonising standards and normative measures in the EU, US, Japan, China, Brazil, and other major trading partners. The mobilisation and networking of relevant stakeholders, such as industrial organisations, public bodies, research organisations, will ensure the effective dissemination and implementation of the developed standards.

Funding Scheme: Collaborative Project (large-scale focused research project).

Additional eligibility criterion: The requested European Union contribution shall not exceed EUR 6 000 000 per proposal.

Additional information: Up to one project may be funded.

Expected impact: Standards will reduce barriers to trade in bio-based products and expand the market potential and the competitiveness of European bio-based industry. Labels and an information list on bio-based products provide consumers and public procurers with clear information on these products' environmental performance, encouraging sustainable choices. Furthermore, the project will contribute to realising the objectives of different relevant

European policy initiatives, including the Lead Market Initiative in Bio-based Products, the Industrial Policy, the Environmental Technology Action Plan and the EU Strategy for Key Enabling Technologies and the Bioeconomy Strategy.

Area 2.3.4 Biorefinery

This area addresses the development and application of industrial biotechnologies for the conversion of renewable raw materials into sustainable and cost-efficient bulk bio-products (e.g. chemicals such as lactic acid, biopolymers), and/or bio-energy. Regarding biofuels, the focus will be on the development of second generation biofuels with improved energy and environmental balance and which avoid the potential food/fuel conflict.

Aiming at achieving integrated and whole crop use of the biomass, biorefineries can use a broad range of biomass feedstocks, ranging from dedicated agricultural, aquatic, forest biomass chains to residues/waste and by-products of biomass-based industrial sectors.

Emphasis will be on the discovery, characterisation and development of novel enzymes and strains with optimised biocatalyst and microbial function for improved production of energy and bioproducts; characterisation of the structure and composition of the feedstock for optimised pre-treatment and fractionation of the biomass into its components; development of improved bio-processes with increased yield, quality and purity through bioprocess design, process optimisation and integration as well as downstream processing; fermentation science and engineering. Environmental and social aspects will also be incorporated.

Preventing and valorising bio-waste in biorefineries

The envisaged broad implementation of the biorefinery concept for the production of biochemicals, biomaterials and bioenergy will generate vast streams of by-products such as hemicelluloses, lignin, tall-oil, glycerol, etc. These fractions are currently widely underexploited as the focus has been placed on primary feedstock components more accessible for conversion. The sustainability and economic viability of the biorefinery concept call for the exploitation of by-products streams and the development of closed loop systems.

The objective of this topic is to develop biotechnology approaches for the conversion of biorefinery by-products into added value bio-based products, such as chemical building blocks, biopolymers. Research could also target the development of physico-chemical technologies which are concomitant to the enzymatic/microbial processes as well as downstream steps for product separation and purification. The feasibility of integrating the approach into a selected biorefinery value chain should be assessed.

Projects will have a strong industry drive and include demonstration activities aimed at proving the techno-economic viability of the developed technologies, including a quantitative technological/economic viability analysis for up-scaling to industrial production. A life-cycle assessment should be carried out in order to evaluate the environmental, economic and social performance of the developed technologies.

Funding Instrument: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional eligibility criterion: SME-targeted Collaborative Projects will only be selected for funding on the condition that the estimated EU contribution going to SME(s) is 25% or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signatures of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: This topic represents a major effort to support innovation in the Biorefinery sector, enhance competitiveness of the European biotechnology industries and provide a considerable effort to the European Bio-economy. The topic aims at financing a limited number of large collaborative projects within an overall maximum budget of EUR 12 000 000.

Expected impact: The economic efficiency and environmental performance of existing and future biorefineries will be enhanced. The projects will create a beneficial economic impact to the bio-based products sector and underpin partnerships and synergies across biorefinery related industrial sectors. The European added value lies in increasing the effectiveness and efficiency of the value chain of bio-based products by reducing losses and generating higher value products or services. The projects will contribute to implementing the objectives of several European policy initiatives, such as the Roadmap to a Resource-Efficient Europe, the Bioeconomy strategy, the Eco-innovation initiatives of the Environmental Technologies Action Plan and the Lead Market Initiative on Bio-based products.

Area 2.3.5 Environmental biotechnology

The concept of the KBBE implies environmental sustainability which will be promoted through the development and application of modern biotechnology.
Research and development activities will provide solutions for sustainable processes and products as well as for preventing and cleaning-up pollution. This will comprise the application of biotechnologies for the design, manufacture and use of more environmentally benign products and processes as well as for applications such us bio-sensors, bio-remediation, waste treatment and recycling[9].
In addition, this area will also foster the application of modern biotechnology for the understanding of microbial biodiversity and ecology (e.g. bacterial cell-cell communication). This approach will expand the understanding on systematics and will lead to the unravelling of new genes, pathways etc. with the potential to enrich several of the biosynthetic domains of biotechnology. It will also serve to the purpose of cataloguing and therefore preserving microbial diversity.

New, fast, and reliable molecular detection methodologies

A number of issues require advancing the development of molecular detection methodologies for various applications, in particular related to: a) pathogen presence and characterisation in foodstuffs, exemplified by the recent EHEC (Enterohaemorraghic Escherichia Coli) crisis; b) compliance with EU legislation on GM food/feed; and c) customs and excise duty purposes, as specified by the Group of European Customs Laboratory (tobacco and other applicable groups of products). Up to now, molecular analytical techniques have become routine diagnostic tools in a broad range of sectors, like human and animal medicine, plant protection, food/feed traceability and will remain relevant, especially PCR (Polymerase chain reaction) diagnostics or related Next Generation Sequencing approaches. In addition, optimal development and application of cost-efficient DNA tools require maximal integration of methods supported through uniform minimal method performance parameters (MPP).

Proposals will aim at two major developments: firstly, to develop at least one new molecular detection methodology, including method validation for each of the applications mentioned under a-c); and secondly, to provide a scientific basis for the establishment of MPP for two

[9] Where wastes can be regarded as feedstocks for bio-processing and biorefinery they shall be dealt with in the respective Areas (2.3.3 and 2.3.4).

key molecular technologies: real-time PCR (including digital PCR, High resolution melting PCR) and Next Generation Sequencing (e.g. whole-genome sequencing, exon-sequencing, meta-genomics). The development of methodologies should be clearly justified on the basis of socio-economic and other applicable impact criteria. The MPP should be documented by benchmarking technological examples from diverse and representative sectors or be experimentally produced within the project. Particular attention is to be paid to the inclusion of methodology support to decision making and to statistically documented uncertainties in the evaluation of the nature/presence of targets under suboptimal conditions (low target quality and/or quantity, stressed or non-culturable cell populations). The use of the methodologies by portable/transportable means is to be considered. Training for stakeholders and dedicated communication activities are considered essential.

Funding scheme: Collaborative Project (small or medium-scale focused research project targeted to SMEs).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 3 000 000 per proposal.

- SME-targeted Collaborative Projects will only be selected for funding on the condition that the estimated EU contribution going to SME(s) is 25% or more of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Additional information: Up to one project may be funded.

Expected impact: The development of at least 3 new highly sensitive detection tools in total, will significantly contribute to improving quality, safety, identity and traceability of bioeconomy products. It is expected that the selected project will not only address shortcomings of current methodologies used in the areas of consumer protection, customs procedures and excise duties, but will even more contribute to accelerate the use of fast and reliable detection tools considered necessary. The development of urgently needed guidance, applicable across a number of areas, will improve overall technological competence, and facilitate development of diagnostic tools and services in the future. It will support flexibility at the analytical, at quality assurance, quality control and at enforcement levels and improve communication between and across sectors.

Scientific forum GMO

This topic aims to provide a forum for independent scientists to provide evidence-based and relevant information about plant biotechnology to target groups like a) EU and national policy and decision makers, b) public administrations in Member States and c) the general public. All pertinent questions from the ongoing EU discussion of plant biotechnology shall be addressed, e.g. scientific reasons for being in favour or against plant biotechnology, but also reasons for not using alternative approaches; benefits and/or potential risks of plant biotechnology, relevant experience gained in major GMO cultivating countries and expected future techno-economic developments. Important ancillary issues in this context, such as potential market dominance of global companies, loss of native landraces/biodiversity, and others should also be answered. Information gathered shall be prepared to specifically address the different target groups.

In order to ensure transparent and unbiased stock taking and communication, proposals will be led by a core group of independent scientists. Due to the major communication efforts envisaged, experienced communication experts must be included in the consortia. Proposed

consortia should embark on discussions with relevant stakeholders, such as independent scientists from outside the EU and candidate/associated countries, EU key media representatives and EU consumer groups. Continuous two-way interaction between scientists and target groups will be based on all available modern communication instruments and tools, including on-line and print media, conferences, workshops, bilateral/multilateral meetings and others.

Funding scheme: Coordination and Support Action (coordinating action).

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 1 000 000 per proposal.
- Minimum number of participants: 3 from different Member States or Associated countries and 3 from ICPC countries.

Additional information: Up to one project may be funded.

Expected impact: It is expected that proposals will address the Commission Communication on the Precautionary Principle and the Conclusions of the Environment Council of 2008 in so far as to acquire and communicate up-to-date and unbiased scientific evidence to the target groups. The selected project is expected to contribute to a) creating a better understanding of risks and benefits of products of plant biotechnology within these groups; and to b) contribute to addressing the lack of trust in the governance and decision making of plant biotechnological products in the EU. It is also expected that the project will contribute to re-establishing application of precautionary measures – if necessary - on a sound basis of proportionality, non-discrimination, consistency, and based on an examination of their potential benefits and costs.

Area 2.3.6 Emerging trends in biotechnology

Novel technologies and new trends in biotechnology will be instrumental for the rational advancement of the KBBE. Yet, not all future trends in enabling technologies and interdisciplinary research can be foreseen. However the potentials of e.g. meta-genomics, bioinformatics, systems biology, virtual cell, synthetic biology, and nano-biotechnology have become rather concrete. These and other fields deserve appropriate measures in terms of research and development to facilitate effective transfer and implementation into industrial applications.

Novel bioinspired materials and processes

The recent convergence of nanoscience and biotechnology has led to the development of entirely new class of materials, devices and technologies often nature-inspired and thus referred to as ‘bioinspired’ or ‘biomimetic’. Nanobiotechnology is an emerging field with potential applications ranging from material, chemical and pharmaceutical industry to environmental technologies, and it has only recently entered the commercial exploration period.

The proposals under this topic should exploit the progress in nanobiotechnology in order to develop innovative bioinspired materials, devices and technologies. The approaches could entail both the biomimetic materials constituted of biological building blocks, as well as those based on innovative biotechnology processing. Research undertaken should give due consideration to the tailoring of the bioinspired materials/technology functionalities for given applications as well as to the industrial need of up-scaling the production. The proposals should include under the same umbrella at least two different approaches among which

biomineralization, biologically produced nanometals and bioinspired polymers could be considered.

Dissemination of the results and activities to users, industries, firms (SMEs in particular) and citizens leading to a better exploitation of research and raising awareness of its potential should be taken on bard within the proposals.

Funding scheme: Collaborative Project (large-scale integrating project targeted to SMEs).

Additional information: Up to one project may be funded.

Additional eligibility criteria:

- The requested European Union contribution shall not exceed EUR 9 000 000 per proposal.
- SME-targeted collaborative projects will only be selected for funding on the conditions that the EU contribution going to SME(s) is 25% of the total estimated EU contribution for the project as a whole. This will be assessed at the end of the negotiation, before the signature of the grant agreement. Proposals not fulfilling this criterion will not be funded.

Expected impact: Research undertaken under this topic should contribute through step changes and solutions in nanobiotechnology. It is expected that they pave the way for future applications and markets thus strengthening competitiveness of European industry and SMEs. The projects should target one or several sectors (e.g. chemicals, pharmaceutical, environment, sensor technology) directly related to this high value added and fast growing field.

Synthetic Biology towards Applications

The combination of engineering and biology that typifies the synthetic biology, makes it a multidisciplinary field of endeavour. Due its nature and multidisciplinary feature synthetic biology has significant potential to influence, and transform a range of areas of our economy and society. Lately, its techniques matured and started to move from the bench to commercial applications. Thus, the projects under this topic should be industry driven, aiming on innovative approaches for different applications - industrial, health, environmental, energy, etc. Key challenges to be considered are the engineering of minimal cells, *de novo* design of robust biomolecular circuits, orthogonal modules and synthetic pathways.

The development of synthetic biology brings with it a number of intellectual property issues, safety, ethical and societal implications. These are crucially important aspects that need to be identified and addressed by any proposal. Applicants should adhere to the Opinion No 25 of the European Group on Ethics in Science and New Technologies to the European Commission "Ethics of Synthetic Biology".

Funding Scheme: Collaborative Project (large-scale integrating project targeted to SMEs)

Additional eligibility criteria: SME and industry-targeted Collaborative projects will be selected for funding on the condition that the requested EU contribution going to SME(s) is 15% or more of the total requested EU contribution. This will be assessed during evaluation and checked during negotiations. Proposals not fulfilling this criterion will not be funded.

Additional information: This topic represents a major effort to support innovation in the European Synthetic Biology sector, enhance competitiveness of the European biotechnology industries and provide a considerable effort to the European Bio-economy. The topic aims at

financing a limited number of large collaborative projects within an overall maximum budget of EUR 20 000 000.

Expected impact: The projects are expected to advance the research in the filed of synthetic biology and to generate innovative tools and methods for biotechnology applications. Using synthetic biology to develop engineered biological systems for a given application is expected to result in accelerated process design and reduced time-to-market. Furthermore, it is expected to result in scientific breakthroughs, which would increase the industrial competitiveness and would create new economic opportunities. The project results should be of interest and benefit to SMEs. A strong participation of SMEs and other representatives of the industry in the project itself should help contribute to the realisation of that benefit.