



Agriculture, Food Security
and Climate Change



FACCE-JPI In brief

www.faccejpi.com

This document is the executive summary to the FACCE-JPI Strategic Research Agenda

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Introduction

The Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) was launched in 2010, bringing together 22 member countries¹. Its aim is to build the European Research Area tackling the challenges at the intersection of agriculture, food security and climate change that cannot be addressed solely at the national level (Figure 1). This is being realised through the alignment and integration

of national and European research programmes, the funding of new research programmes, and through exploring innovative approaches for the member countries to work together to address the challenge of ensuring a secure food supply to an ever-increasing global population in the context of climate change.

1 Austria, Belgium, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Ireland, Israel, Italy, The Netherlands, Norway, Poland, Romania, Spain, Sweden, Switzerland, Turkey and UK. New Zealand joined as an Associate Member in 2016.

FACCE-JPI VISION: An integrated European Research Area addressing the challenges of Agriculture, Food Security and Climate Change to achieve sustainable growth in agricultural production to meet increasing world food demand and contributing to sustainable economic growth and a European bio-based economy while maintaining and restoring ecosystem services under current and future climate change.

FACCE-JPI MISSION: To achieve, support and promote integration, alignment and joint implementation of national resources in Europe under a common research strategy to address the diverse challenges in agriculture, food security and climate change.

In 2012, FACCE-JPI launched its Strategic Research Agenda, which outlined the research challenges in FACCE-JPI's remit across five Core Themes, and detailed short-, medium- and long-term research priorities in each of these themes. Given FACCE-JPI's achievements to date, advances in scientific research and shifts in the international policy context of

FACCE-JPI's remit, 2016 saw an update to the original Strategic Research Agenda. This update refreshed the original five Core Themes, reframing them around new, more impact-driven research priorities (see Table 1) which will be the focus of FACCE-JPI's efforts over the coming years.

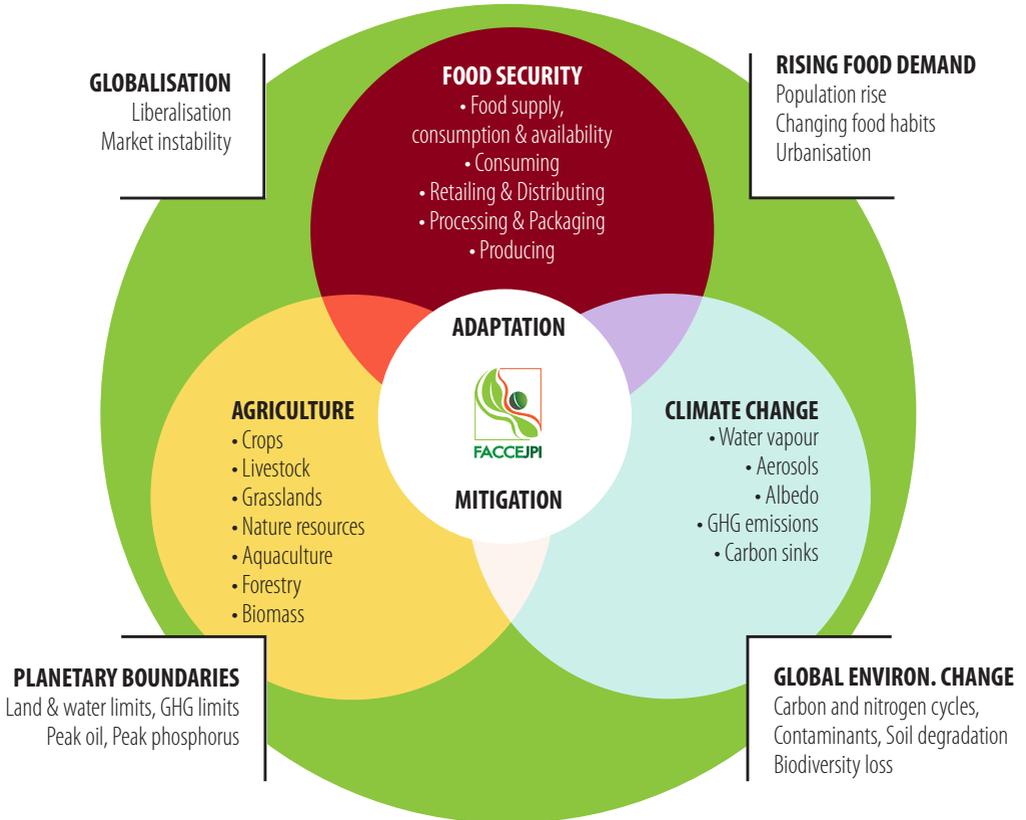


Figure 1: A vision of research areas in FACCE-JPI showing drivers (in white) and highlighting interactions between agriculture, food security and climate change



Policy context



Photo: Nina Pitkänen

Recent policy events including the launch of a new Sustainable Development Agenda² and the Paris Agreement³ have highlighted the real need for a coordinated approach to tackling the challenges of food security and agriculture in a changing climate. The United Nations 2030 Agenda for Sustainable Development has been launched with 17 Sustainable Development Goals (SDGs). One of the aims of this new agenda is both to be more efficient in attaining food security for all, and to better integrate the social and ecological dimensions of sustainability (inequalities, biodiversity degradation and greenhouse gases emissions as well as the impacts of future climate changes). The Paris Agreement, reached at the 21st Conference of the Parties to the UN Framework Convention on Climate Change (COP21), included an objective to limit the global average temperature increase to 1.5 °C above pre-industrial levels, and to increase the ability to adapt to the adverse impacts of climate

change in a manner that does not threaten food production. FACCE-JPI has an important role to play in achieving these targets and the SDGs through the joint actions taken to implement the FACCE-JPI research priorities, thus putting the importance of food security and agriculture at the heart of national and international climate agendas. The role of FACCE-JPI has also been highlighted in the European Commission's new strategy for agricultural research and innovation⁴, where FACCE-JPI is named as a key partner in developing synergies between Member States and the EC, and enhancing the integration of European research programmes. Furthermore, FACCE-JPI aims to provide a strong evidence base to inform policies such as the Common Agricultural Policy, the Bioeconomy Strategy, the emerging strategy on Food and Nutrition Security, as well as the 2030 Climate and Energy framework.

2 <http://www.un.org/sustainabledevelopment/development-agenda/>
3 <http://unfccc.int/resource/docs/2015/cop21/eng/l09.pdf>
4 <http://ec.europa.eu/programmes/horizon2020/en/news/designing-path-strategic-approach-eu-agricultural-research-and-innovation>

European and international collaboration

Recognising the importance of cooperation in addressing the challenges of agriculture, food security and climate change, FACCE-JPI has adopted a European and International Strategy⁵ which aims to:

- Promote greater complementarity and structuring of research at European and international levels to address global challenges in a more effective way;
- Improve the international visibility of FACCE-JPI and enhance the impact of aligned European research on European policymaking and innovation; and
- Facilitate the exchange of information and mutual learning with similar research initiatives in other regions of the world.

The strategy identifies three broad target groups for interaction at both the operational and strategic levels: European initiatives and partners, international initiatives and partners, and third countries.

⁵ <https://www.faccejpi.com/Strategic-Research-Agenda/European-and-International-Strategy>



FACCE-JPI achievements⁶

In its first six years, FACCE-JPI has already achieved a great deal in research excellence and alignment, having launched several actions, mobilising approximately €120M of funding for transnational research activities (80% of which comes from national budgets), with a further €50M to be invested in upcoming actions. These actions have included several joint calls, through ERA-Nets (FACCE ERA-Net Plus 'Climate Smart Agriculture', FACCE-SURPLUS, FACCE ERA-GAS) and jointly with other European initiatives, international partners and non-EU countries (Belmont Forum, ERA-Net BiodivERsA, multi-partner call on agricultural greenhouse gas research, WaterWorks 2015), and developing novel instruments such as the Knowledge Hub MACSUR⁷. The research in MACSUR and its outcomes have helped inform policy decisions by contributing to the IPCC's fifth assessment report. FACCE-JPI has helped to identify new approaches for sustainable agricultural development (e.g. through research conducted as part of the ERA-Net Plus on Climate Smart Ag-

riculture) and to increase the visibility of European research on agriculture, food security and climate change on a global scale. It has organised European-wide scientific events and strengthened its links with national programmes and the European Commission.

6 This section reflects achievements at the time the Strategic Research Agenda was published (January 2016). The FACCE-JPI website provides a regularly updated list of FACCE-JPI's achievements.

7 MACSUR: Modelling European Agriculture with Climate Change for Food Security (<http://macsur.eu/>); further achievements of MACSUR are highlighted in the ERA-LEARN 2020 Case Study.

Core Themes



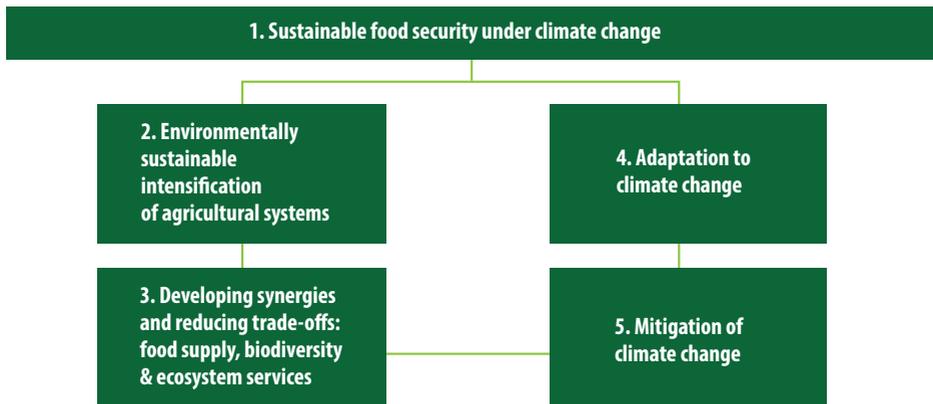


Figure 2: The five Core Themes of the FACCE-JPI Strategic Research Agenda

Core theme 1

Sustainable food security under climate change

This Core Theme addresses two interlinked aspects of food security:

I. Identifying key vulnerabilities of the European food system to climate change

- Integration of biophysical and socio-economic models to analyse the potential impacts of changes in agricultural policies and in other parts of the bioeconomy sector in Europe, under different climate change scenarios
- Integrated risk analysis of European agriculture (and food systems, including food supply and value chains) under climate change: test responses to volatility both from natural and market phenomena
- Understanding Europe's role in international markets and its impacts on price volatility and global food security

II. Identifying policy options to increase resilience of European food systems under climate change

- Develop contrasted scenarios (with or without climate change adaptation) including recognition of public perceptions on how food is produced and policy dialogue
- Modelling the impacts (economic, social and environmental impacts as well as impacts on global food security) of changes in the bioeconomy sector in Europe under different policy options
- In partnership with the private sector, identifying options (policy and technological) for helping food systems (throughout the value chain and to the consumer) become resilient to external shocks resulting from climate change
- Combine observations, experiments and modelling through the development of appropriate European research infrastructures.

Core theme 2

Environmentally sustainable intensification of agricultural systems

The scope of Core Theme 2 includes:

- Providing improved farm management and intensification practices that increase resource use efficiency and economic returns at the farm level and meet the goals of low environmental footprint alongside enhanced food security under current and future climate and resource availability
- Understanding recent yield trends in Europe, taking into account changes in costs and prices and research investments as well as changes in environment, management and genotypes
- Benchmarking efficiencies of resource use (water, land, nitrogen, energy) across Europe under diverse Genotype x Environment (including climate) x Management combinations and assessing total factor productivity
- Integrated crop health management and integrated animal health management in the context of climate change
- Low input, higher efficiency seeds and breeds i.e. producing more with less inputs
- Knowledge-based IT innovations in agriculture
- Improved understanding and control of soil functioning and biotic interactions at field to landscape scales.

Core theme 3

Developing synergies and reducing trade-offs between food supply, biodiversity and ecosystem services

Core Theme 3 is concerned with the following issues, in the context of climate change:

- Developing methods for assessing and valuing biodiversity and ecosystem goods and services (e.g. carbon sequestration, water storage...) in intensive agricultural systems
- Developing approaches for developing synergies and reducing trade-offs between agriculture and ecosystem services in a variable environment (climate change, price volatility...) at both farm and landscape scales
- Developing a solid knowledge basis for the provision of public goods by European agriculture, so that ecosystem services are delivered efficiently and effectively
- Providing new approaches to the increased use of functional biodiversity in agricultural systems (e.g. intercropping, mixtures, conservation agriculture...)

Core theme 4

Adaptation to climate change

Core Theme 4 covers the following aspects of adaptation to climate change:

- Adaptation options to climate change and increased climatic variability throughout the whole food chain, including market repercussions
- Regional strategies to adapt production systems to cope with climate change
- Adapting seeds and breeds through conventional and modern breeding and biotechnology to new combinations of environment and management: e.g. abiotic stress, elevated CO₂
- Systems of climate change-sensitive monitoring of pests and diseases and developing climate-informed crop and animal protection
- Strategic adaptation to climate change through improved land management and land use change
- Adaptive water management in agriculture, watershed management, flood management, irrigation technologies, and water re-use
- Adapting markets, institutions and insurance mechanisms to increased climatic variability and climate change.

Core theme 5

Mitigation of climate change

Core Theme 5 is concerned with the following aspects of mitigation of climate change:

- Contributing to reductions and removals of GHG emissions through carbon sequestration, substitution of fossil-based energy and products, and mitigation of N₂ and CH₄ emissions by the agriculture and forestry sectors, while reducing the risk of GHG emissions associated with indirect land use change
- Developing cost effective monitoring and verification methodologies of field, animal and farm scale GHG budgets, possibly including indirect land use and cradle to grave life cycle analysis
- Developing verifiable GHG mitigation and carbon sequestration measures in farming systems
- Developing technologies and methods to substitute fossil-fuel energy through increased use of biomass and other renewable energies in the agriculture sector also ensuring climate resilient sustainable agriculture for food and non-food systems without jeopardising food security.



Research Priorities

Research priorities for each of the five Core Themes were developed as a collaboration between the Scientific and Stakeholder Advisory Boards and the FACCE-JPI Governing Board, and based in part on common national research priorities. This inclusive approach ensures that the actions of FACCE-JPI are supported and owned by the member

countries, have an evidence-based scientific grounding, address the needs of the end-users of the research, and have an impact in the longer term on the societal challenge the JPI aims to address, namely sustainable food security in the face of climate change. The research priorities are shown in Table 1.

Implementation of the SRA

The updated Strategic Research Agenda paves the way for FACCE-JPI's next course of action aimed at addressing the challenges at the crossroads of agriculture, food security and climate change. The FACCE-JPI SRA will be implemented through successive Implementation Plans, which will address the research priorities using existing and new instruments, maximising the impact of European research in these critical times. Instruments include joint calls,

workshops, Thematic Annual Programming Networks, Knowledge Hubs and Knowledge Networks. To ensure that FACCE-JPI, its joint actions and research projects are achieving the aims and objectives of the JPI, an on-going process of monitoring, evaluation and impact assessment is being carried out in parallel with the development of new actions through the successive Implementation Plans.

Table 1: Overview of priorities of the revised FACCE-JPI Strategic Research Agenda

Core Theme	Priorities
Core Theme 1: Sustainable food security under climate change	
CT 1	• Climate change risk assessment for agricultural production systems (plant and livestock), and food supplies
	• Climate change risk assessment for value chains, prices, international trade and food security, including changes in consumer behaviours and waste
	• Reducing volatility in agricultural production and food markets in the bioeconomy to stabilise food security in the context of climatic variability
	• Assembling existing (and emerging) technologies for primary production, fostering the adoption of improved technologies that are (on the edge of being) mature but not yet widely adopted
	• Identification of the impact of food losses in the whole chain, and identifying interventions to decrease the waste.
	• Pathways of economic development in Europe of non-food use of biomass, consequences for food supply and for land use change, biomass production, carbon sequestration, and prices and trade.
	• Coordinating policies to support food and nutrition security in the context of climate change
Core Theme 2: Environmentally sustainable intensification of agricultural systems	
CT 2	• Identifying crop yield potentials and yield gaps across regions in Europe under current and future climate scenarios. Implications for input use and management. Include considerations on quality of crop products
	• Identifying animal production potential and production gaps across regions in Europe under current and future climate scenarios. Implications for input use and management. Include considerations on quality of animal products
Core Theme 3: Developing synergies and reducing trade-offs between food supply, biodiversity and ecosystem services	
CT 3	• Assessing and valuing ecosystem services and their resilience in agricultural systems and landscapes under climate change
	• Designing and assessing the impact of incentive mechanisms to support increased provision of ecosystem services in agriculture, including conditions for uptake and socio-economic elements
Core Theme 4: Adaptation to climate change	
CT 4	• Identifying constraints to adapting agricultural land, soil and water management for a variety of local farming systems
	• Phenotyping, genotyping, breeding and reproduction for adaptation to climate change with crop, pasture and livestock species and evaluating alternative species
	• Climate change induced transformation of farming systems towards alternative types of production and links with changes in logistics and relocation of industries, investments. Scale of production is also an issue that we need to link to social and economic dimensions
	• Adapting specific value chains to climate change from the field to the fork with special emphasis on nutritional quality, food safety and stability accounting for consumer preferences
	• Integrated crop health management under climate change, with focus on emerging pests and diseases, epidemiology and deployment of resistance genes, links to soil and landscape biodiversity
	• Integrated animal health management under climate change with focus on emerging pests and diseases, interactions between wild and domesticated components at landscape scale
	• Increasing economically viable input use efficiency by improving water quality and soil function, and better use of fertilisers.

Core Theme	Priorities
Core Theme 5: Mitigation of climate change	
CT 5	<ul style="list-style-type: none"> Alternative land use systems (agroforestry, hedges, mixed farming systems) and land and soil management systems (soil conservation, legumes and soil biology) for building above and below ground carbon stocks and increasing biomass production for food and non-food uses
	<ul style="list-style-type: none"> Technical and economic potential of GHG abatement, including enhanced soil carbon storage, in livestock and crop systems and in integrated systems
	<ul style="list-style-type: none"> Lifecycle analysis of products and of typical diets. Alternative food systems with low carbon footprint
	<ul style="list-style-type: none"> National inventories improvement; Measuring, Reporting and Verification (MRV) options
	<ul style="list-style-type: none"> Research forest fires: Smart forest management to decrease forest fires recurrence and increase forest resilience. Preservation of biomass and soil, avoiding CO₂ emissions. Study of future scenarios due to spreading risk of forest fires in Europe due to climate change

Cross-cutting Priorities	
CT 2 and 4	<ul style="list-style-type: none"> Cooperation with ICT: smart farming and food security
CT 2 and 4	<ul style="list-style-type: none"> Sustainably increasing productivity, resilience and resource use efficiencies (including soil and water) at the agricultural system scale, across regions in Europe, based on improved use of genetic resources and advanced management technologies ('management by measurement') in the context of climate change
CT 2 and 4	<ul style="list-style-type: none"> Plant and animal production systems for better human nutrition and resilience to climate change
CT 1, 2 and 3	<ul style="list-style-type: none"> Identification of the impact of urbanisation on organisation of food chains, and identifying new connections between water, food, energy and logistics to realise climate-robust and input-efficient production chains
CT 1, 2, 3, 4 and 5	<ul style="list-style-type: none"> Identifying the potential role of big data for food security with a focus on collecting data, translating data into information, and promoting and facilitating use of the information by end-users (incl. via open data/knowledge policies)
CT 1, 2 and 5	<ul style="list-style-type: none"> Explore and exploit refinery concepts for the multiple use of biomass under climate change, taking economic and environmental implications into account



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