FACCE-JPI

Strategic Research Agenda 2020

Joint Programming Initiative on
Agriculture, Food Security and Climate Change

Publishing directors
Hartmut Stalb, Gudrun Langthaler

Coordination and directors for non-scientific contributions
Heather McKhann, Anja Berndt

Directors for scientific contributions
Frank Ewert, Gianluca Brunori

Contributors
Pablo Gómez, Annia Domènech

Design and Layout
Brenda Kuzniar-van der Zee & Communication Services
Wageningen University & Research

Photos
Pixabay.com

Icons
Made by Freepik from www.flaticon.com

October 2020

FACCE-JPI is supported by funding from the European Commission (Coordination and Support Action FACCE Evolve, contract number 652612) and FACCE-JPI member fees.

Table of contents

Abbreviations

AKIS	Agricultural Knowledge and Innovation Systems
CAP	Common Agricultural Policy
CCAFS	Climate Change, Agriculture and Food Security
CGIAR	Consultative Group for International Agricultural Research
COP	Conference of Parties
CSA	Coordination and Support Action
CT	Core Theme
ERA	European Research Area
FACCE-JPI	Joint Programming Initiative on Agriculture, Food Security and Climate Change
FAIR	Findable, Accessible, Interoperable, and Reusable
FAO	Food and Agriculture Organisation of the United Nations
FNS	Food and Nutrition Security
GB	Governing Board
GHG	Green House Gases
GRA	Global Research Alliance on Agricultural Greenhouse Gas Research
HDHL	JPI Healthy Diet for a Healthy Life
IP	Implementation Plan
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
JPI	Joint Programming Initiative
JRC	Joint Research Centre of the European Commission
KIC	Knowledge and Innovation Community
OECD	Organisation for Economic Co-operation and Development
R&I	Research & Innovation
RRI	Responsible Research and Innovation
SAB	Scientific Advisory Board
SCAR	Standing Committee on Agricultural Research
SDG	Sustainable Development Goals
SRA	Strategic Research Agenda
StAB	Stakeholder Advisory Board
TFEU	Treaty on the Functioning of the European Union
UNFCCC	United Nations Framework Convention on Climate Change
WG	Working Group

Foreword from the FACCE-JPI Chairs

In 2020, the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) is entering its second decade of existence. This anniversary is also a time for reflection and renewal. Given the current political and societal context, FACCE-JPI has taken the opportunity to take a step back to review its achievements, its ambitions and its future. With these factors in mind, the update of the Strategic Research Agenda (SRA), last done during 2015, is more profound this time around, in order to better reflect the current scientific, societal and political context.

Today, our societal challenges are more urgent than ever (see "Challenges in food security, agriculture and climate change). Looking forward, it is clear that feeding the world will require a major transformation in the way that we produce, manage and consume food in order to achieve sustainable and resilient agricultural production systems that can at the same time help mitigate GHG emissions and adapt to changing environmental conditions, while providing food and nutrition security. We need to rethink the European food system within the global context, what and how we produce and trade food, reduce waste and losses, and adopt an agroecological approach that safeguards biodiversity and ecosystems services in order to meet multiple challenges: sustainable carbon neutral and resilient production systems, conserving soil, water and biodiversity resources, while producing high quality food. We also need to consider the causes and impacts of system shocks, such as the COVID-19 pandemic and climate change, that require risk reduction and proactive responses. As FACCE-JPI, we need to provide high quality research to support Europe's sustainable transition, by providing an evidence base to policy makers, producers and consumers. This implies aligning existing research, generating new cutting-edge research and having a strategy for making the results known to relevant end users and policy makers.

European Member States and Associated Countries need to cooperate more than ever to cope with the growing challenges. The European Commission has set out to make Europe the frontrunner for climate and green ambitions, requiring significant investment in research and innovation, which should provide the foundation of future policy decisions. The European Research Area needs to be reinforced.

FACCE-JPI is a leading Member State-driven initiative that over the last ten years has worked at the intersection of challenges linked to agriculture, food security and climate change. In the current context of continued urgent global challenges and changing political priorities, FACCE-JPI is rising to the occasion with its own new and ambitious plan. The updated Strategic Research Agenda reflects months of work, taking into account FACCE-JPI's past work and achievements, feedback from the members of FACCE-JPI as represented in the Governing Board on both the structure of the document as well as their national priorities that need to be highlighted and our past and ongoing work with other European and international initiatives. It also takes into account the context of Horizon Europe with its new mission areas and partnerships. Accordingly, the FACCE-JPI Scientific Advisory Board and Stakeholder Advisory Board have worked with the Governing Board to propose a new vision and mission and 4 new core themes, which are presented here in an accessible document. As before, this SRA will be implemented through successive Implementation Plans, which in contrast to the past, will develop each topic in detail.

Through the co-creation approach used to prepare this document, we hope to create a positive feedback loop between those in Member States and Associated Countries involved in research programming and FACCE-JPI so that we can work together to tackle the enormous challenges we face in an effective and synergistic manner to achieve a positive impact on Agriculture, Food Security and Climate Change.

Finally, we would like to express our sincere thanks to all those involved in elaborating this document. This SRA was a collaborative effort between the three FACCE-JPI boards (GB, SAB, StAB) and the Secretariat. We thank the SAB/StAB working groups who contributed to the core themes, and the Secretariat members who contributed to the overall document. A special mention goes to Gianluca Brunori and the FACCE-JPI Secretariat, especially Heather McKhann, Anja Berndt and Brenda Kuzniar-van der Zee.

Hartmut Stalb
Chair Governing Board

Frank Ewert
Chair Scientific Advisory Board

Rebeca Fernandez
Chair Stakeholder Advisory Board

Executive Summary

With this renewed Strategic Research Agenda, FACCE-JPI will create valuable knowledge and impact to feed into policies and practices, continuously contributing to tackling the societal challenge of transformation towards sustainable agriculture respecting natural boundaries, securing biodiversity, reducing emissions while at the same time contributing to climate neutrality, and sufficient and healthy food and diets.

FACCE-JPI consists of 23 European members and New Zealand as an associated member, with a governing structure that not only connects relevant national ministries, policy makers and funding organisations but also has access to and is guided by the latest scientific expertise and stakeholder advice. Since 2010, FACCE-JPI has united its members to align research efforts in order to tackle societal challenges related to food security, agriculture and climate change. So far, FACCE-JPI has funded over 120 projects worth a total of €250 millions of funding, involving roughly 900 project partners from nearly 500 organisations in mainly newly established collaborations. This research has not only given rise to over 600 publications of high scientific quality, but it was also invaluable for capacity building and providing training for over 300 PhD students. This updated SRA outlines how FACCE-JPI will continue to align and co-design research and deliver knowledge for addressing the challenges of sustainable and resilient agricultural production systems integrating the interdependent climate system, food system and ecosystem.

In four core themes, this SRA outlines a path towards an agricultural sector that respects the planetary boundaries, preserves and encourages biodiversity, reduces emissions and inputs, embraces new approaches such as agroecology, and at the same time provides a sufficient and healthy diet.

Core Theme 1

An agricultural sector that contributes to climate neutrality - investigates the changes needed to reduce the agricultural contributions to climate change. This includes the reduction of greenhouse gas (GHG) emissions, and the improvement and conservation of carbon storage, driven by technology development and changes in agricultural practices and dietary habits.

Core Theme 2

Sustainable & resilient agriculture - focusses on the need to transition to more resilient farming practices, better adapted to the impacts of climate change. For this, major changes to adapt to societal and economic developments are needed and the value of ecosystem services has to be recognised. The associated risks require careful management in order to establish successful resilient farming enterprises fulfilling all dimensions of sustainability.

Core Theme 3

Nutrition-sensitive agricultural production for food security - addresses the need to provide sufficient, healthy and nutritious food for all. It highlights the changes necessary to get away from a diet mainly based on available calories and to go towards diverse diets based on nutritional quality. Dietary diversification and a focus on nutritional quality will not only help to increase the diversification of production systems but also support attempts to tackle serious issues such as malnutrition and obesity.

Core Theme 4

Trade-offs and synergies between food production, ecosystems and climate - will enhance our understanding of the trade-offs and synergies between food security, biodiversity, ecosystems and climate and create support to take decisions for end users. For this, better attention to ethical issues is needed as well as closer connection between science and policy, and the improvement of methodology to establish the economic value of ecosystem services.

These core themes are not only closely related but also further connected through cross-cutting topics such as life science generating innovation with radical transformation potential for the primary production sector, the increasing need to better include Responsible Research and Innovation (RRI) approaches, the awareness of societal change, the use of context-specific approaches, and the importance of research to inform policy.

FACCE-JPI's work is tightly connected to and guided by several international and European policies such as the European Green Deal, the Farm to Fork strategy and the Paris Agreement (COP21) to name but a few. With our renewed strategy, we will contribute to enabling decision makers, farmers, industry, consumers and, last but not least, the research and innovation communities to find solutions which secure food for all and at the same time respect our planet's boundaries.

Challenges in food security, agriculture and climate change

Today's agriculture and food production systems are at a crossroads: continue on the path that could jeopardise their future resilience and sustainability (1) or face critical challenges ahead. A key global challenge is to sustainably increase the supply of healthy and nutritious food and other ecosystem services for 9.7 billion inhabitants by 2050 (2), while maintaining economic and social development from limited resources under the pressures imposed by the effects of climate and environmental change. Providing Food and Nutrition Security (FNS) in this changing world is a priority with increasingly interconnected challenges affecting European and food systems worldwide (3).

Agriculture interacts and coexists with ecosystems and biodiversity, and shapes the environment and diversity of the European landscape with positive or negative effects (e.g. 7). An efficient agricultural system relying more on agroecological principles and functioning ecosystems enriches and relies on biodiversity and other ecosystem services. Agriculture also depends on natural resources such as soil, water, air, radiation and is strongly connected to the climate. In addition, agriculture is vulnerable to climate change: crop yield, animal production, biodiversity, and water use, as well as soil health are directly affected by a changing climate. Extremes in climate can decrease crop productivity, resulting in price increases for many important agricultural crops. Therefore, climate change is likely to contribute substantially to food insecurity in the future. In some regions water required for food production may become scarcer due to increased crop water and urban use, and drought and floods may become more frequent. Competition for arable land may increase as certain areas become unsuitable for production. At the same time, according to the 2019 report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) "transformative change" is needed to combat accelerated extinction of species and decline in ecosystem health at a global level (8).

These adverse effects are already having an impact on agricultural production in some parts of Europe, especially in the South. Extreme weather events, including recent heat waves are causing economic losses for farmers and for the EU agricultural sector with large regional variations. Agricultural crop and livestock production are expected to decrease in some regions of the EU with poorer harvests and higher production costs, affecting the price, quantity and quality of production.

Trade patterns will also be affected. Global trade and free trade agreements are questioned in the context of sustainability and global crises caused by the negative effects of climate change such as droughts, viruses, pests and diseases, leading to some countries developing their own approaches to ensure the sustainability of food systems. Paradigms that proposed over the last 25 years that food and nutrition security will not be threatened in the EU are going to be challenged, not just because of increasing demand for food worldwide, which will result in higher food prices, but also because of the need to consider the sustainability of continuing to import natural resources and raw materials for food production (9).

At the same time that it is strongly affected by climate change, agriculture is also a driver of climate change (9). Although these emissions have decreased since 1990, greater efforts are needed to achieve the EU emission reduction targets for 2030 and 2050 (9).

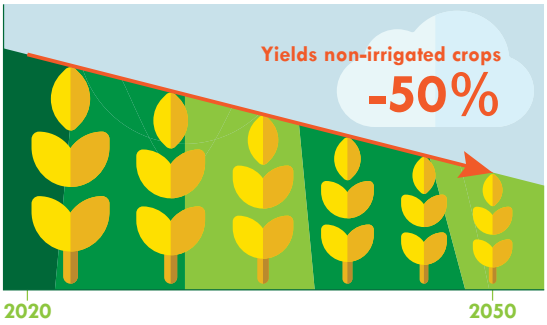
The tight interconnection between agriculture and climate change means that mitigation efforts are crucial in a path towards carbon neutrality through reducing GHG production and increasing carbon sequestration, while adaptation measures would reduce damage from these impacts and increase the resilience of agri-food systems. The additional stress on land created by climate change exacerbates already existing risks to livelihoods, biodiversity, human and ecosystem health, infrastructure and food systems. Increasing impacts are projected in all future scenarios with higher or unforeseen risks. Cascade risks

Agriculture accounts for 49% of the Earth's ice-free land (4).

Agriculture accounts for 70% of the global use of fresh water (4).

Food systems, including production and consumption, represent about 30% of energy consumption (5).

In the European Union (EU), agriculture represents about 50% of the community territory (6).



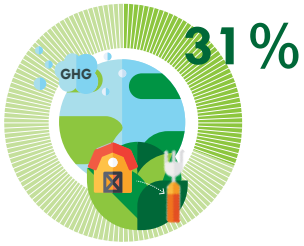
The yields of non-irrigated crops are expected to decrease by up to 50% in southern Europe by 2050 (9).

The value of agricultural land in some parts could be reduced by more than 80% by 2100 leading to land abandonment (9).

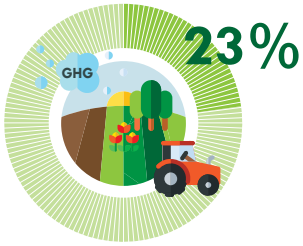
with impacts on multiple systems and sectors also vary across regions (4). Meta-analysis of impacts of climate change shows a reduction in crop yields by 2030, which might result in increased food prices and reduced food production, and climatic extremes which may exceed the critical thresholds for agriculture (10). Impacts on food systems are expected to be widespread, complex and geographically and temporarily variable (11).

In the face of these challenges, public awareness is also increasingly shifting to questions concerning how food is produced, consumed and disposed of. Consumers are demanding sustainable production with less chemical inputs, high standards of food nutritional quality and safety, more transparency and less waste. At the same time, the double burden of malnutrition and increasing levels of obesity, often linked to poverty, is a worrying trend for long-term food system sustainability. Europe needs to consider how to reshape its food systems to be sustainable and resilient in the context of global developments.

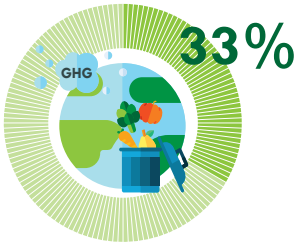
Science must be mobilised to address the increasing challenges that global and national food systems face with respect to research on agriculture, ecology, nutrition and health, and for encompassing public and private sector research (5). In this context, cross-border collaboration offers the opportunity for a more efficient use of scarce resources. The Joint Programming Initiatives (JPIs) bring a new dimension to European research through alignment so as to avoid duplication, fill gaps and create critical research mass (13). FACCE-JPI has been working successfully for the last 10 years to define the critical research elements needed for a European response to these challenges. This revised SRA aims to continue and reinforce this FACCE-JPI commitment towards sustainable and resilient agri-food systems with an integrated approach to climate, food and ecosystems.



Globally, the food system as a whole represents up to 31% of total global human-induced GHG emissions (12).



Agriculture, forestry and other land use (AFOLU) activities are responsible for 23% of GHG emissions in the past decade (4).



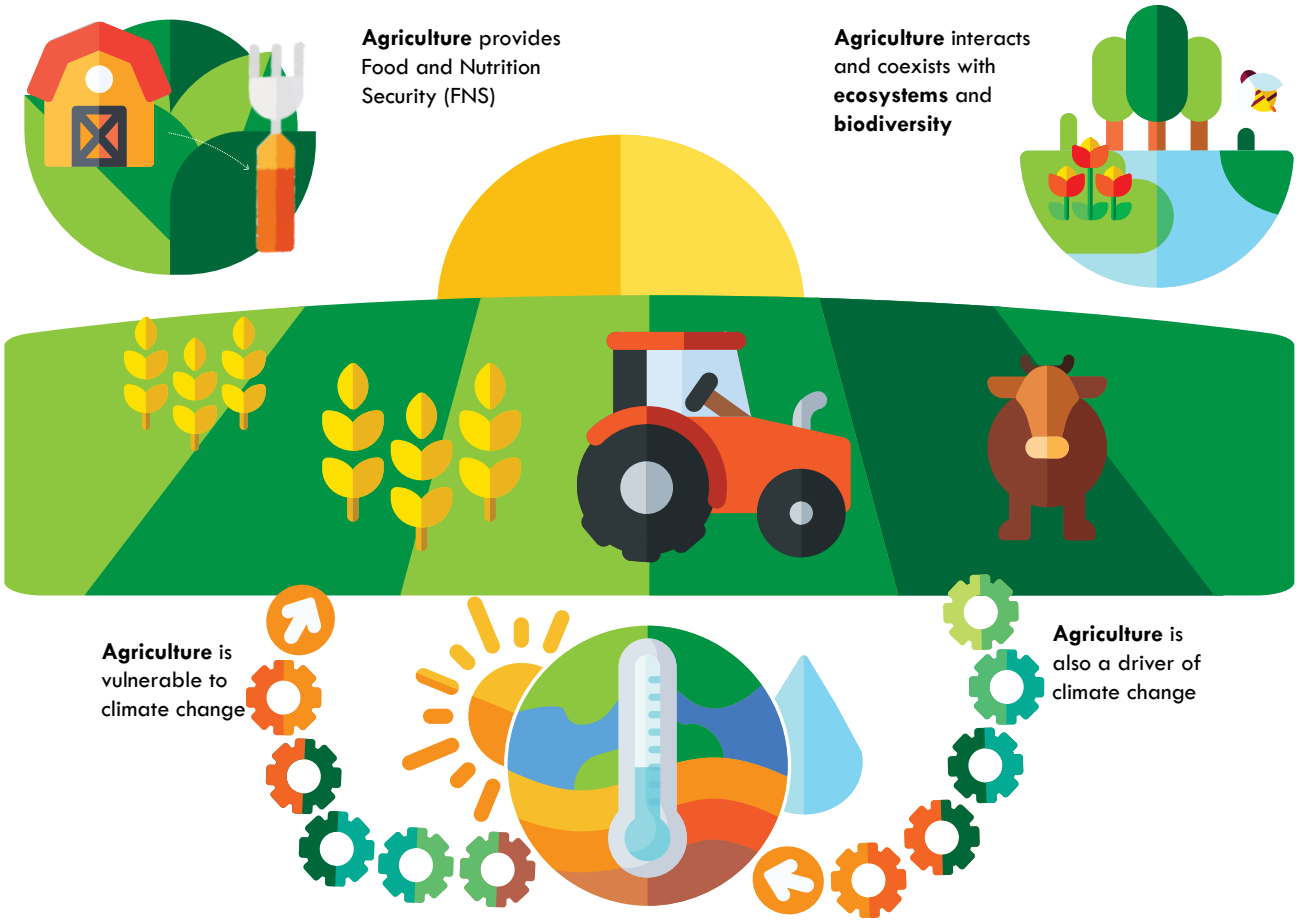
Up to one third of world food production is lost or wasted (5), therefore increasing the amount of unnecessarily produced GHG emissions and putting additional pressure on resource use.

At the European level, agriculture accounts for about 10% of all GHG

FACCE-JPI addresses challenges in food security, agriculture and climate change

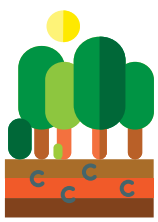
A key global challenge is to sustainably increase the supply of healthy and nutritious food and other ecosystem services for 9.7 billion inhabitants by 2050, while maintaining economic and social development from limited resources under the pressures imposed by the effects of climate and environmental change.

9.7 billion inhabitants by 2050

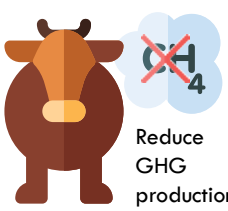


Science must be mobilised. Cross-border collaboration offers the opportunity for a more efficient use of scarce resources. FACCE-JPI has been working successfully for the last 10 years to define the critical research elements needed for a European response.

Mitigation efforts are crucial in a path towards carbon neutrality

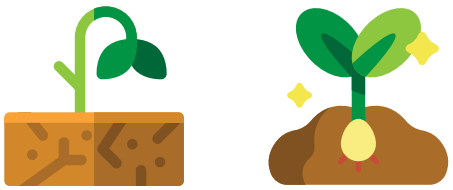


Increase carbon sequestration



Reduce GHG production

Adaptation measures reduce damage and increase resilience of agri-food systems



Icons Freepik from www.flaticon.com

FACCEJPI

Scope and Core themes

This 2020-2027 Strategic Research Agenda proposes a renewed approach to the FACCE-JPI main objectives. It takes stock of FACCE-JPI's history and the current urgent research needs, both European international. It contains four core themes and a renewed vision and mission.

Scope

The FACCE-JPI mission statement implies that research activities and resources will be concentrated on agricultural production systems but with a strong consideration of interactions with i) the food system, ii) the climate system and iii) the ecosystem and possible system shocks.

A systems approach will include a strong link between the production and the climate system. The pledge to climate neutrality, as remarked in the Farm to Fork strategy (15), requires a clear identification of agricultural systems that have the potential to meet this standard. Hence, with the explicit consideration of the link between the agricultural production system and the climate system, FACCE-JPI plans to continue its activities to better understand, manage and change agricultural production systems to anticipate climate adaptation and mitigation targets.

FACCE-JPI Vision

A European Research Area addressing sustainable and resilient agricultural production systems to provide adequate and nutritious food and to contribute to a climate neutral Europe by 2050.

FACCE-JPI Mission

Aligning and co-designing research, and delivering knowledge for addressing the challenges of sustainable and resilient agricultural production systems integrating the climate system, the food system and the ecosystem.

The link between the agricultural production systems and food and nutrition security will entail a deep understanding of the interdependence of agriculture with the broader food system. Agriculture is considered one of the components of food and nutrition security and its role will be to produce safe, nutritious, culturally acceptable agricultural products, without exceeding planetary boundaries. Broader system implications will be considered as drivers or outcomes of production systems. FACCE-JPI

= System shocks

A vision of FACCE-JPI domains in which the main perspective is taken from agricultural system but interactions with the food system, the climate system and the ecosystem are explicitly considered as well as sudden shocks to systems that can potentially cause crises to the food system such as the COVID-19 pandemic (see also text box on the next page).

FACCE-JPI and the post-COVID-19 world

COVID-19 has accelerated a reflection on the risk of system shocks. The food system is both a potential co-cause of the pandemic (COVID-19 as a zoonosis, which started at the interface between humans and animals) and a bearer of COVID-19 systemic impact. COVID-19 has hit the food system in multiple respects: vulnerable consumers, break-down of many business activities, panic buying, disrupted supply chains, shortage of inputs and of labour, wastage of food because of lack of buyers and of excessive panic buying. Lessons learned from the COVID-19 crisis have led FACCE-JPI to propose to: a) integrate the risk of systemic shocks as a key component of the FACCE-JPI vision; b) account for different system shocks related to the food system (e.g. COVID-19), the production system (e.g. price spikes), the climate system (e.g. extreme events) and the ecosystem (e.g. pollution-induced ecosystem degradation and collapse); c) adapt the research agenda with a high priority for the analysis of risks that may affect these systems; d) study the most vulnerable subsystems; e) look for the strategies to reduce vulnerability; f) link short-term response to long-term challenges.

research will consider developments in food and material processing, retailing strategies, standards and related feedbacks for the design, organisation and management of agricultural production systems at cropping, farming, landscape, country and global levels.

Specific consideration of interactions between agricultural production and the surrounding ecosystem is a third focus area of FACCE-JPI in response to alerting reports regarding biodiversity losses, degrading natural resources and environmental pollution. Therefore, progress in agro-ecological research will be central to the development of sustainable production systems and will receive particular attention by FACCE-JPI.

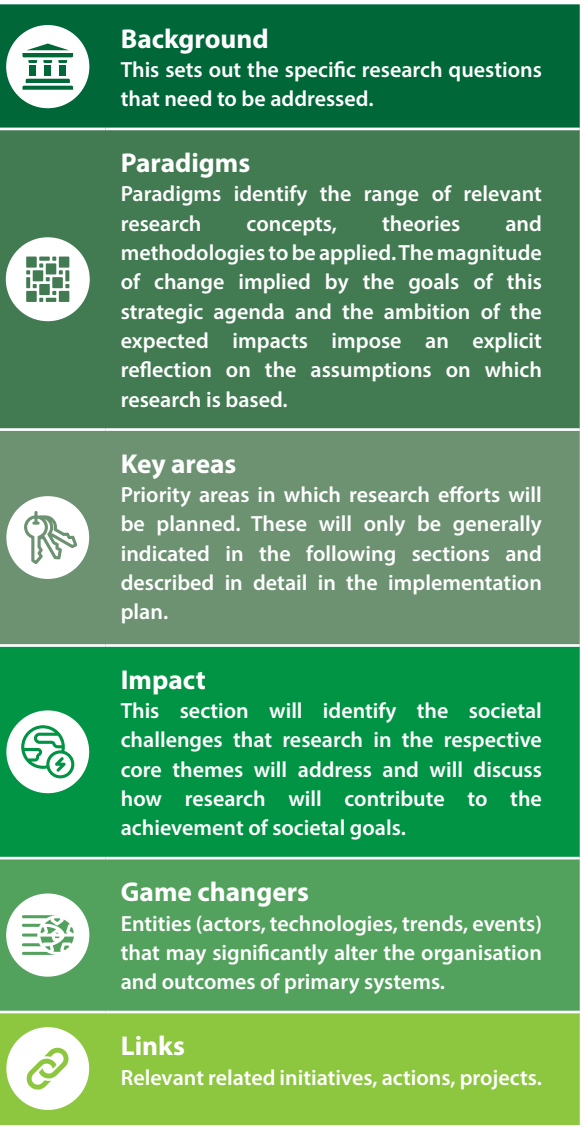
Sustainability concerns the assessment of ecological, economic, social, health and ethical considerations, with the related trade-offs. Scientists will be asked to highlight the multidimensionality of the impact of food production and the relative synergies and trade-offs. Hence, FACCE-JPI will also explicitly support research activities to better understand and optimise synergies and trade-offs among multiple sustainability goals to guide the management and design of new agricultural production systems.

With the possibility that the COVID-19 pandemic may impose a major impact on human health and the world economy, creating a crisis in the entire food system, we explicitly aim to also account for such system shocks and ways to build resilience against them.

The four new FACCE-JPI core themes (CT) are:

- CT1: An agricultural sector that contributes to climate neutrality,
- CT2: Sustainable & resilient agriculture,
- CT3: Nutrition-sensitive agricultural production for food security,
- CT4: Trade-offs and Synergies between food production, ecosystems and climate.

The following descriptions of each core theme are structured according to 6 main items that refer to:



Cross-cutting issues

A number of cross-cutting issues relevant for all core themes are not repeated in the individual descriptions. Particular attention will be dedicated to ***digitalisation and its impacts***. Given the expected disruptive nature of the new wave of information technologies, special attention will be given to the contribution of digitalisation to the common good, and at the same time to issues such as digital devices, autonomic machines including robots, data ownership, privacy or digital security.

Another major cross-cutting field will be ***life sciences***, as the convergence with data science and rapid development in disciplines such as synthetic biology is generating a new wave of innovations, some of which may radically transform the primary sector as we know it. The benefits of those new biotechnology applications will have to be weighed against the unexpected consequences and the potential social costs, thereby strengthening the need for the ***inclusion of Responsible Research and Innovation*** in all research activities.

A third relevant issue is related to ***social change***. Societal challenges imply behavioural change (consumption, lifestyle, social interaction), and technological change can accelerate both processes of creation and destruction of social value. A fourth cross-cutting issue is the importance of a ***context-specific approach***, able to detect the distribution of costs and benefits across places and different social groups. Specific attention will be dedicated to the rural-urban differences.

Overall, it is important to remark the ***relevance of research*** on all themes ***to policies***. Research should be able to provide indicators, models and evaluation tools able to improve the capacity of policy making to respond to complex or unanticipated changes and shocks to the system.

Core Theme 1

An agricultural sector that contributes to climate neutrality

Background

Meeting the challenges described in the European Green Deal (14; see Policy Context) can be achieved by transforming the management of land and food systems. The transformation needs to be underpinned by improved understanding of the underlying processes, new technologies and management systems, optimised for contributing to carbon neutrality, as well as assessing barriers and co-benefits. In line with the EU Farm to Fork strategy (15) and the planned changes in the Common Agricultural Policy, a number of strategies to reduce emissions and increase and protect carbon stocks will be required. These strategies will need to enhance productivity while reducing net emissions, so that the production of food and biomass leaves the smallest possible climate footprint. This must be complemented with ways of compensating for unavoidable emissions from agricultural activities. Environmental standards and development goals defined by the UN 2030 SDG Agenda (16) will also need to be met.

Paradigms

Agricultural activities contribute to anthropogenic global warming, primarily through biogenic net-emissions of CO_2 from cultivation of land (e.g. peatlands) and through emissions of CH_4 and N_2O from livestock and organic and mineral fertilisers. These emissions originate from intensified biological carbon and nitrogen cycles in agricultural systems, where microbial processes determine emissions and affect soil carbon storage. Further, the production of mineral fertiliser and the fuel used for field and farm operations are important sources of CO_2 emissions. Reducing these emissions therefore requires addressing many mechanisms at soil, plant and animal level, but also at the level of the farming system and the value chain, including the industrial scale. The ambitions for reducing global warming can effectively only be achieved if GHG emissions from agriculture are greatly reduced and land areas are used for some form of offsetting (negative emissions), e.g. change in the radiative balance and enhanced carbon storage of the agricultural landscape through changed crops, cropping systems and agroforestry affecting soil and vegetation properties. This is linked to paradigms such as agroecology and climate smart agriculture.

Key areas

The research and innovation under this core theme will cover research areas such as: Carbon neutrality of Sustainable Food Systems, which will comprise systematic evaluation of changes of agri-food chains supporting more climate friendly diets; Deployment of carbon farming solutions, addressing the development and economic feasibility of practices aiming at reducing GHG emissions, increasing soil carbon storage (grasslands, forests, soil cover) and enhancing the reflection of solar light; Reducing carbon footprints through circular biomass chains, focusing on new biomass production systems coupled with biomass refining and low emission waste management systems; Strategies to reduce GHG emissions based on improving understanding of the microbiome of soils and animals, specific technologies for reducing methane and nitrous oxide from livestock, manure systems and soils, and genetic improvement of plants and animals with lower emissions; Optimising carbon neutrality through digital technologies, as data management and modelling systems will allow quantification of net GHG emissions across spatial scales and along food and material chains; Protection and enhancement of landscape carbon stocks, focusing on protecting the large carbon stocks of peatlands through water management.

Impact

The overall impact will be the reduction of net warming contributions from agriculture and land use through improved knowledge of biological mechanisms related to GHG emissions and carbon sequestration and the impact of different system configurations on global and local warming. This will ultimately contribute to progress towards the ambition of climate neutrality in the EU at the latest by 2050, in line with the Paris Agreement (17; see Policy Context) objective. Improved knowledge and strong advisory services will allow the economically feasible development and implementation of carbon neutral agricultural practices and biorefinery technologies, through circularity and offsetting, as well as monitoring and prediction tools. This core theme will support the sustainable use of resources with a view to preventing soil degradation and restoring soil health, and will provide science-based recommendations, setting ambitious, but realistic and achievable objectives for the implementation of the Paris Agreement (17) and the European Green Deal (14).

Game changers

There are a number of scientific, societal and technological game changers that will support this research: societal push for less livestock products; functional biodiversity to sustain high productivity, low external inputs and carbon neutrality; manipulation of microbial functions to reduce the level of GHG emissions; bio-refining technologies that reduce waste, save energy and enhance carbon retention of soils; digital technologies that substantially improve the capacity of monitoring and predicting the behaviour of agricultural systems and provide a foundation for financially rewarding net emission reductions; co-development and demonstration of technologies and production systems to enhance implementation of carbon neutral practices by farmers.

Links

At the international level, this theme links to research and networking organisations, e.g. GRA (Global Research Alliance on Agricultural Greenhouse Gases), LEAP (Livestock Environmental Assessment and Performance), 4 per 1000 initiative, and Global Soil Partnership. At the European level, this links to several research programs and projects, e.g. JPI Climate, Agricultural European Innovation Partnership on Agriculture (EIP Agri), Climate KIC, European Joint Programme Cofund on Agricultural Soil Management (EJP Soil), Coordination and Support Action on Soil Mission Support (SMS), CIRCASA (Coordination of International Research Cooperation on Soil Carbon Sequestration in Agriculture), BBI-JU (Bio-based Industries Joint Undertaking), CSAs on Agroecology (AgroEcoLLNet-Prep and AE4EU).

Core Theme 2
Sustainable and resilient agriculture

Background

The relationship between climate change and farming is double sided. On one hand, farming systems account for 23% of total global GHG emissions (see Core Theme 1). On the other hand, climate change impacts farming systems' production potential in interaction with other factors. This dichotomy requires the search for farming practices and policies that reinforce sustainable and resilient farming. However, the narrow profit margins achieved by many farmers make them reluctant to take risks that might threaten their livelihood. At the farm level, a transition is needed to circular farming systems that are better adapted to climate change, better manage ecosystems sustainably and help to increase biodiversity. This may imply not only major changes in farming practices, but also wider structural changes to adapt to societal and economic developments through, among others, quality standards, governance patterns, trade rules, and marketing strategies able to communicate to consumers the value of ecosystem services.

Paradigms

Sustainable and resilient farming systems need to meet all three dimensions of sustainability - bio-physical, socio-cultural and economic - and be an integral part of the larger food, climate and ecosystems to be able to produce a wide variety of ecosystem services. Research and farming approaches such as agro-ecology, transitional and transformational farming, risk management, economic stability, agrobiodiversity, climate smart farming, conservation farming/regenerative agriculture, circular farming, organic farming and many more can have a transformative role at the farming system level but also at the level of the broader bioeconomy, as they can inspire new products, new business models, supply chain configurations, cooperation among firms, trade relations, responsible business and marketing conduct. Moreover, it is important that these practices are constantly improved and adapted to the specific contexts, particularly in relation to weather volatility due to climate change. The effectiveness of different farm practices and their combinations should be monitored, and the information be made readily available to the farming community. The implications of these practices in improving farmer's livelihood and for the bioeconomy and governance should also be determined.

Key areas

The challenge is to develop production systems that are resilient against climate and other changes as an integral part of any successful farming enterprise, and to reduce, and where possible eliminate, food loss and waste, to achieve full circularity of food systems, and to build diversified food production systems. The key areas that need to be addressed include both biophysical and socio-economic aspects of farming activities, having a clear understanding of the constraints and opportunities offered by the food system in given contexts. For instance, biodiversity (both in terms of market valorisation and agrobiodiversity), soils as a key element for both adaptation and mitigation, water use and quality, reduction of (synthetic) chemical pesticide use, crop-livestock integration and participatory breeding are relevant farm-level topics. At a broader level, climate effects and services, ecosystem services, environmental pollution (including pesticides, antimicrobials, harmful nutrients, fertilisers), nutrient recycling and resource (water, soil, land) use and management are also important. From a socio-economic and equity perspective, economic stability, space for agriculture, access to land, farm succession, the role of production within the food chain structure and its governance and trade relations should be investigated. Specific attention should be dedicated to data generation and modelling, enhanced and multi-criteria assessment of production sustainability, risk management, impact assessment and improving production efficiencies and synergies (both crop and livestock).

Impact

The overall impact will be more economically and ecologically efficient production through improved management and responsible use of natural resources and ecosystem services. The use of diverse crops and farming systems will enable a better adaptation to climate and societal changes, while regenerating degraded soils. The reduction of pesticide and fertiliser application will also contribute to healthier soils and ecosystems. Diversification of farm outputs will increase biodiversity as well as economic opportunities. This will ultimately contribute to improve the farmers' health and livelihood, while strengthening the existing policy recommendations for the implementation of the EU's Farmland regulatory frameworks that promote sustainable land-use planning. Finally, activities under this key area will be essential to the Farm to Fork Strategy (15) and the Biodiversity Strategy (18) in the context of Product Environmental Footprint (PEF) methodologies and of the Farm Sustainability Data Network and will contribute to performance-based policy.

Game changers

Game changers for sustainable and resilient, profitable agricultural systems may include social innovation, co-creation of knowledge (indigenous knowledge and practices, outreach and dissemination), novel breeding technologies, diversification of farming systems (local seeds and breeds, crops and cropping systems, decision support systems like climate scans that helps farmers to make the right decisions) and biological control of pests and diseases.

Links

At the international level, this theme links to the CGIAR programme CCAFS (Climate Change, Agriculture and Food Security) and the Global Research Alliance (GRA) and to the 4 per 1000 initiative. At the European level, this links to the Food KIC and the Climate KIC and emerging Horizon Europe partnerships on biodiversity and water as well as the partnerships on agroecology and food systems.

Core Theme 3

Nutrition-sensitive agricultural production for food security

Background

Approaches to understand food systems under climate change and how they can be transformed to ensure food security and food safety for all, while reducing their environmental footprint, need to consider healthy and balanced diets. While undernutrition is on the rise with over 800 million people suffering from hunger, micronutrient deficiencies affect nearly one billion people. Overweight concerns 1.3 billion people and obesity affects more than 700 million people. The emphasis on nutrition in food security tends to go beyond the idea of sufficient calories, implying a different approach to food production from the perspective of a balanced and healthy diet, with adequate micronutrient and nutrient availability. Nutrition has become a growing concern for consumers in both industrialised and developing countries, and the food and drink industry is responding quickly to this trend, with significant impacts for producers.

In this context, nutrition-sensitive agriculture is a food-based approach to agriculture that puts nutritional quality, dietary diversity and food fortification at the heart of profitable agricultural practices, plant and animal breeding, organisation and function of supply chains. It also takes into consideration the revalorisation of by-products as animal feed.

Paradigms

An important approach uses impact pathways that link agricultural practices to sustainable and healthy diets (e.g. integrated approaches like agroecology) without trespassing planetary boundaries. It questions the meaning of productivity, as the concept of nutrition-sensitive agriculture frames productivity not in terms of yields, but in terms of nutritional density, with the implication that it is possible to nourish better with less biomass. Moreover, dietary diversity implies diversification of production systems. The One Health perspective is also particularly relevant here. Central to One Health is the understanding of healthy food as an outcome of the interconnection between people, animals, plants, that requires an interdisciplinary and trans-disciplinary approach, and that addresses issues such as prevention of food-borne diseases and reduction/elimination of harmful chemical residues.

Key areas

The key areas of research to be addressed include the diversification of genetic resources, of agricultural practices, of production systems also considering presently less important crops as drivers of design and delivery of diverse healthy diets as seen in a food systems and value chain approach. This will also need the consideration of consumer/citizen engagement as a driver for diversification and healthy diets. This would imply research on new plant protein sources, production of proteins/leguminous crops under climate change, the biofortification of food and alternative protein sources (e.g. insects etc.), the link between feed and food. The impact of climate change and of agricultural practices on the nutritional value of food should also be investigated. Moreover, this theme addresses the role of responsible consumption and the organisation of local food systems around the goal of improving people's diets. Trade-offs between food safety and nutrients and bioactive compounds should be further studied in relation to food processing and safety (highly processed food vs. mild processing). The system implications of a shift in land use (e.g. plant protein or aquaculture) and their impact on the nutritional health of consumers should also be considered, as well as social innovations and identification of promising consumer - producer linkages.

Impact

The expected impact is a higher level of nutritional quality of food and the diversification of production systems in terms of plant and animal genetic resources and practices, enabling a diversified set of sustainable and nutritious food choices for consumers. These food options will be more nutritious and possess an optimised nutritional content. They will achieve a number of desirable outcomes such as i) reducing obesity and micronutrient deficiency; ii) meeting the dietary needs of specific population groups, such as children, women and the elderly; iii) reducing the risk of transmission of foodborne diseases; iv) reducing pressure on healthcare systems; and iv) reducing the environmental footprint of food systems, including through improved nutrient cycling.

Game changers

Potential game changers in this area include technological innovations such as digitalisation, genomics and gene editing, and synthetic biology, which is a multidisciplinary area of research that seeks to create new biological parts, devices, and systems, or to redesign systems that are already found in nature. Aquaponics and other integrated aquaculture innovations also potentially have an important role to play in improving nutrition while decreasing impacts on land and marine ecosystems. The development of alternative protein sources and responsible sourcing of ingredients for animal and fish feed are other potential game changers. Understanding their implications for human health and the environment is a prerequisite to the adoption of these alternative foods. They also include trends, drivers and attitudes in consumption, encompassing intergenerational differences in attitudes, stratification within a population, age, socio-economic situation, rural-urban, etc.

Links

At the international level, this theme links to the CGIAR programme CCAFS, and the FAO and its programmes. Links at the European level are to the JPIs HDHL (Healthy Diet for a Healthy Life) and Oceans, the Food KIC, the future European partnership on food systems.

Core Theme 4

Trade-offs and synergies between food production, ecosystems and climate

Background

Given the challenges for agriculture described above in the descriptions of CT1-3, future research needs to address trade-offs between food security, biodiversity, ecosystems and the climate in an explicit way. This will provide policy makers with insights based on a range of disciplinary perspectives that can help make coherent and consistent choices to achieve the transformations required.

Paradigms

Trade-offs raise important political and ethical implications, as dealing with them implies decisions that may distribute unevenly costs and benefits, and on which knowledge – given that it is related to future impacts - is uncertain. Research should support policies in finding win-win or second-best solutions or by improving knowledge of the systemic relationships – the nexus between food, natural resources and their respective management systems. This will imply a more extended application of nexus approaches, a stronger attention to ethical issues, and an intensified interaction between science and policy. Responsible Research and Innovation (RRI), stresses the role of researchers, research institutions and funding organisations in addressing societal challenges.

Key Areas

This theme calls for research approaches that explore feasible and desirable sustainable transitions of local, national, regional, European and global systems. To achieve this, a transdisciplinary research effort is needed across the natural and social sciences.

There is a need for improved understanding and quantification of the interdependence of food production, non-food production (including bioenergy production), ecosystem services and biodiversity at multiple spatial scales. The debate on biodiversity and ecosystem services protection in managed landscapes has largely been cast as a choice between land sharing and land sparing. Land sharing implies integration of production and biodiversity and ecosystem service objectives on all lands. Land sparing allocates land to different uses according to the potential of the land. However, this dichotomy is too simplistic and crucially depends on the production system, ecosystem service functions and biodiversity elements in focus. There is a need for new system level approaches that seek to identify system level mechanisms of transition to more sustainable European food and non-food systems, rather than optimisation approaches of subcomponents of existing production systems.

Improvements of the methods to economically value ecosystem services considering the interlinkages with food production and biodiversity is important. In addition, the concept of payments for ecosystem services should be further developed and integrated in the ecosystem cascade. There is also a need for the development of integrated modelling approaches, including enhanced life cycle assessment (LCA) methodologies able to encompass synergies in agroecosystems, aspects that are critical for long-term sustainable food production and the preservation of natural capital (such as soil fertility and erosion; biodiversity impacts; toxicity of mycotoxins, agrochemicals, etc.; impact of pesticides for soil, environment, biodiversity and human health); analysis of social metabolism (flows of materials and energy that occur between nature and society), integrated assessment models of food systems, spatial models of ecosystem services and biodiversity conservation provisions. This effort is needed to improve understanding of the interconnectedness of the systems and for understanding unintended consequences of policy initiatives. Multi-criteria assessments should provide an interface between scientific evidence and societal values. Such models are needed across different production systems, varying from intensive to more extensive production systems across European biogeographical regions and global agro-ecological-climatic zones, and extended to the broader food systems.

In the context of European and confronted national level policies there is also a need to evaluate policy effectiveness as well as coherence and consistency with societal challenges. Innovative policy designs should be tested on the ground, for example through *ex-ante* policy experiments in the lab and field.

Analysis of incentives and barriers/lock-ins for innovation towards sustainability in the European agri-food sector should be conducted to achieve a better understanding of how improved governance through local-global initiatives could support the transition of food systems and avoid negative consequences of such initiatives.

Impact

In the short-run, the identification of potential trade-offs and important nuances in managing complex systems can help farmers, policy makers, business operators and consumers to make more informed choices to achieve more sustainable outcomes and avoid the unintended consequences of targeting only a narrow set of goals in agricultural and trade policies. The research will help to highlight the conflicting and synergising contributions expected from the European agricultural sector to meet societal goals over the next decades stipulated in national and international policy documents (i.e. SDGs (16), Paris Agreement (17), European Green Deal (14), Farm to Fork Strategy (15), CAP). A focused effort on the research topics outlined above is crucial for improved governance of complex systems. In view of the need to ensure food security to a growing world population, the research can in the long-run support transitions to more innovative and productive food systems which fit within planetary boundaries.

Game changers

A key game changer in this area will be a clear political willingness to pursue policy coherence accounting for trade-offs to achieve progress on the SDGs. The urgency is reflected both in pressure from civic society to act on multiple goals, public sector demands for improved governance frameworks, and increasingly from private sector initiatives through e.g. corporate accountability frameworks. On the European scene, the promotion of the multi-actor approach can stimulate more intense and true involvement of different relevant actors in the value chain/food system, can stimulate a more transdisciplinary research agenda. Furthermore, digitalisation and increased access to common research platforms and databases can be a valuable resource for research in this field going forward.

Links

Links will be established with the emerging European partnership on biodiversity. Other links will be consistent with those described above under CT1-3.

Policy context

The challenges that FACCE-JPI aims to address are high, and increasingly so, on the global and European policy agendas. These policies, often described as "calls to action" must orient future FACCE-JPI research and in turn, be informed by the results coming from FACCE-JPI actions. Below is a non-exhaustive summary of relevant policies.

At the international level, the United Nations Sustainable Development Goals (SDGs) (16) describe a set of 17 interrelated goals which are described as "an urgent call for action by all countries". Changing course is critical: "business as usual" is no longer an option (1). Many of the 17 SDGs are relevant to the food system (16). These range from ending hunger and improving nutrition (SDG2), stopping land degradation and loss of biodiversity (SDG15), to forging a global partnership for sustainable development (SDG17). Without fixing the food system, the SDGs simply cannot be achieved (19). Fully meeting these objectives will take time (20) and will require additional research efforts to address GHG emissions, to avoid depleting agricultural systems resources, to manage the demand for resource-intensive animal feed products and to reduce food loss and waste, among other challenges (1).

The 21st Conference of the Parties to the UNFCCC (COP21), held in Paris in December 2015, reached a landmark agreement, the Paris agreement (17), to combat climate change and to accelerate and intensify the actions and investments needed for a sustainable low carbon future, with the intention of setting the foundation of a new universal regime, with mitigation and adaptation on an equal footing. The Paris Agreement recognised the fundamental priority of safeguarding food security, and the specific vulnerability of food production to the adverse impacts of climate change. The EU contribution to these objectives to reduce emissions by 40% is framed in the EU's 2030 climate and energy framework and associated targets.

FACCE-JPI addresses SDGs 2, 12, 13 and 15.

Policy is informed by a number of international bodies that aim to provide an evidence base for policy making, such as the Intergovernmental Panel on Climate Change (IPCC), the United Nations body for assessing the science related to climate change and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), which assesses the state of biodiversity and of the ecosystem services it provides to society.

At the European level there has also been a clear and urgent call to action in the 2020 European Green Deal (14), which is even more ambitious than previous targets. It aims to "transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are **no net emissions of greenhouse gases in 2050** and where economic growth is decoupled from resource use". This sets an ambitious target to make the EU carbon-neutral by 2050. The Green Deal is a roadmap with specific actions that include the Farm to Fork strategy (15), the Biodiversity Strategy (18), Zero pollution strategy, the circular economy action plan and the European Climate Pact and European Climate Law. The latter is at the heart of the European Green Deal. It enshrines the 2050 climate neutrality target into law. It is a strong signal of the Commission's commitment to leadership on climate. These objectives have contributed to changing the policy narrative, moving from a vision that puts market forces at the core of development to a vision that acknowledges the interaction between biosphere and social sphere, accepting the idea that there are physical limits to growth, and sets an ethical compass to economic activities. Research has a primary role in this new scenario. The new research policy framework, Horizon Europe, stresses the need to improve the returns on research investments. It identifies the missions that research will have to accomplish, and links project evaluation and selection to the capacity of the projects to contribute to them.

The Farm to Fork strategy (15) is especially relevant to FACCE-JPI and specifies that food must remain safe, nutritious and of high quality and be produced with minimum impact on climate, the environment and natural ecosystems.

These priorities require a robust and ambitious framework programme for research and innovation as has been set out in Horizon Europe. Two new concepts in Horizon Europe are the Missions and the new Partnerships. These new tools aim to increase the effectiveness of funding by pursuing clearly defined targets.

The Common Agricultural Policy (CAP), launched in 1962, is the EU policy to provide financial support to farmers in Member States. Among its aims are to "help tackle climate change and the sustainable management of natural resources and to maintain rural areas and landscapes across the EU"[1]. The new CAP proposal puts increased emphasis on Agricultural Knowledge and Innovation Systems (AKIS) and thereby promotes science-practice-policy interfaces. Other EU policies that are relevant to FACCE-JPI include: Water Framework Directive, including the Nitrates Directive, and the Habitats Directive, both implemented under Natura 2000, the Sustainable Use of Pesticides directive and the European Protein Plan.

MISSIONS AND EUROPEAN PARTNERSHIPS

A new feature in Horizon Europe is the addition of missions. These aim to increase the effectiveness of funding by pursuing clearly defined targets. Five mission areas have been defined of which two concern FACCE-JPI: "Soil health and food" and "Adaptation to climate change including societal transformation". The Commission will engage with citizens in a continuous process for the design, monitoring and assessment of the missions since one of the mission goals is to make it easier for citizens to understand the value of investments in research and innovation.

Another significant change is in the area of partnerships. Following the request of Member States to simplify the partnership landscape, a new typology of partnership has emerged. The aim of these partnerships is to deliver on global challenges and industrial modernisation through concerted research and innovation efforts. Three types of partnerships are proposed: Co-programmed (between the Commission and private and/or public partners; based on memoranda of understanding and/or contractual arrangements); Co-funded European Partnerships using a programme co-fund action (partnerships involving EU countries, with research funders and other public authorities at the core of the consortium) and Institutionalised European Partnerships (based on article 185 of the Treaty on the Functioning of the European Union (TFEU)). Currently 49 partnerships have been proposed of which two particularly concern FACCE-JPI: "Towards more sustainable farming: agro-ecology living labs and research infrastructures" and "Safe and Sustainable Food System for People, Planet & Climate" although a number of others concern FACCE-JPI to a lesser extent. There are still many remaining questions on how these partnerships will function and how FACCE-JPI, with its 10 years of experience in partnering, can play a role.

[1] https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/cap-glance_en

How we will deliver the SRA

The FACCE-JPI Strategic Research Agenda is delivered through Implementation Plans that cover 2-3 year periods. Through an iterative process, involving the GB, the SAB and the StAB, research priorities are identified and included in the Implementation Plan (IP). The first IP covered 2014-2015, the second one 2016-2017, the current one 2018-2020 and the next one is being prepared.

Through the FACCE-JPI IPs, participating countries are continuing to find new ways to work together to achieve harmonisation and streamlining of national research. With the goal of achieving the common FACCE-JPI Strategic Research Agenda, FACCE-JPI promotes three main types of transnational activities: aligning already funded national projects and programmes; supporting new research; and exploring new avenues of research. FACCE-JPI has used a combination of these approaches to work towards the top-level aim of JPIs which is to ensure the European Research Area is achieved through national efforts in key societal challenges in addition to EU programmes.

To deliver the FACCE-JPI goals as set out in this SRA, additional programmes will continue to be developed through joint actions in which several countries in variable geometry participate voluntarily and on the basis of their respective political and financial commitments and strategies. FACCE-JPI defines such new programmes through dialogue among participating countries to identify common research priorities.

As described in its "Strategy for Cooperation and Coordination with European and International Initiatives"[2], when mutually beneficial, collaboration with other European and international initiatives is explored and undertaken. FACCE-JPI has established links to an extensive range of other initiatives, including other JPIs (in particular, JPI Climate, JPI Water, JPI Healthy Diet for a Healthy Life, JPI Oceans), ERA-NETs, international initiatives (for example the Global Research Alliance in Agricultural Greenhouse Gas Research, the 4 per 1000 initiative etc.). FACCE-JPI has participated in the H2020 projects PLATFORM and ERA-LEARN 2020 and currently is involved in FIT4FOOD 2030.

FACCE-JPI has used a variety of instruments to implement its programmes including calls for research projects (in several cases through an ERA-NET action) but also more innovative alignment instruments developed by FACCE-JPI such as the Knowledge Hub, the Knowledge Network, Thematic Annual Programming (see Annex 3) and exploratory workshops. FACCE-JPI will continue to use these instruments to deliver its SRA and will reflect on ways to reinforce alignment of national research programmes. In developing new actions, the following questions are considered:

- What is the added value of this action? At national level or at EU level or at global level?
- How is innovation taken into account in this action?
- What technologies (new or existing) will be important for the success of this action?
- What international links could/should be established?
- What other initiatives/research actions (e.g. other JPIs) could be linked to this action? What is the best way to do this?
- What are the expected impacts of the action (scientific, societal, economic, environmental…)?

[2] https://www.faccejpi.net/en/show/FACCE-JPI_Communication_and_Valorisation_strategy_29-March-2017_FINAL_secure.htm

How we will deliver impact

Effectively addressing our societal challenges means ensuring that results are relevant, available to various end users and of are of high quality. Dedicated activities of FACCE-JPI concern increasing and demonstrating the impact of FACCE-JPI research.

Ensuring relevance begins at the time FACCE-JPI actions are decided. Each action begins by a scoping activity bringing together the views of the GB, representing national interests, the SAB for scientific guidance and the StAB for desired impacts and most often other relevant experts and policy makers. Each action has a steering committee and usually a dedicated workshop. For joint calls, the evaluation of proposals for projects also takes into account their capacity to contribute to responding to the societal challenges that FACCE-JPI addresses.

A second key step is stakeholders' involvement and engagement in the research projects from design through to execution and completion in a multi-actor approach. This allows co-creation of knowledge and the development of solutions tailored to specific contexts and users. It also encourages researchers to adopt a problem-oriented, rather than a technology-oriented, approach. Improved knowledge will also allow the design of innovative policies and interventions.

A third key step is making sure that the results are accessible. In addition to the scientific publications resulting from FACCE-JPI projects, articles addressing a broader audience have been published and other communication tools have been used such as brochures and newsletters. A data management policy has been adopted by the GB that promotes FAIR[3] practices, including access to data. Moreover, FACCE-JPI has dedicated significant efforts to making researchers aware of the need to make results available to policy makers and other end users such as farmers. In 2016, FACCE-JPI published the FACCE-JPI Communication and Valorisation Strategy: "Science for Policy and Impact: Communication and Valorisation of FACCE-JPI results"[4]. This strategy has been implemented by a number of workshops on science-policy exchange which have been organised within and across FACCE-JPI actions.

Certain new actions are entirely dedicated to bridging science and policy such as the SciPol Knowledge Hub that is a follow up from the MACSUR Knowledge Hub. During this next period, FACCE-JPI will continue these efforts and reinforce them, in particular through an interactive tool that is being developed which allows all FACCE-JPI projects to be visualised according to specific criteria as well as enhanced publication of synthesis reports on specific topics (e.g. soil, food and nutrition security etc.).

Concerning the high quality of the research, FACCE-JPI has adopted a Monitoring and Evaluation framework[5] that was published in 2013. This defines 3 targets to be monitored and evaluated:

Target 1: improving the alignment of national and European research programs;

Target 2: increasing high quality transnational research activities within the areas of food security, agriculture and climate change, and

Target 3: improving the societal impact of research on the challenge of food security, agriculture and climate change.

The framework and subsequent work have established indicators for these targets, especially Targets 1 and 2. A first round of evaluation was carried out in 2016 to look at Target 1 and a second round took place in 2019 on Targets 1 and 2. The latter provided a baseline for the level of high quality transnational research activities by analysing its scientific publications through a bibliometric analysis.

This sound and goal-orientated monitoring and evaluation process can also support the effective implementation of the initiative to achieve its goals and objectives. Monitoring, evaluation and impact assessment will enable learning from past successes and challenges and will inform decision making so that current and future activities can be adjusted according to the initial, and if applicable, revised goals of FACCE-JPI.

[3] https://www.force11.org/group/fairgroup/fairprinciples

[4] https://www.faccejpi.net/upload_mm/e/1/a/d537cf68-255f-41ae-8b66-2212819bc5bc_FACCE-JPI_Communication_and_Valorisation_strategy_29-March-2017_FINAL_secure.pdf

[5] https://faccejpi.net/application/files/1815/5540/4781/FACCE-JPI_-_Monitoring_and_Evaluation_Framework_Final_draft_v_3.pdf

Annex 1.
FACCE-JPI in brief

What is Joint Programming

According to the latest available OECD data (21), the combined spending of the EU28 nations for research and development in 2017 totalled US$367 billion, compared to US$484 billion for the United States, US$445 billion for China and US$155 billion for Japan. Considering the similar ratio of researchers amongst the working population in the EU28 and the US, European research and development investments only reach about 80% of what is available per researcher in the US.

By aligning research priorities, strategic goals and funding processes, research and innovation (R&I) efforts can achieve critical mass and thereby greater impact through the pooling of resources, both human and funding. It is the pooling of funding that is most critical for the European R&I sector to keep up with and stand up against the biggest research investing countries and create impact from their achievements and research outcomes.

Joint Programming Initiatives (JPIs) were set up to support European national research activities in tackling the societal challenges of our time that are too big to be tackled at the level of individual countries, thus bringing critical mass and avoiding duplication of efforts. This includes for example addressing climate change, ensuring energy and food supply, or enabling healthy ageing of citizens. JPIs achieve this through aligning policies, setting common strategic goals, and coordinating R&I efforts and investments. These aims both strengthen and support the European Research Area (ERA), a pan-European unified research area that enables free circulation of researchers, scientific knowledge and technology.

Who we are

The Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) was officially launched by the European Council in October 2010 with the goal of providing coherence in research programming across Europe to jointly address the challenge of developing agricultural systems that meet food security, adapt to climate change impacts and mitigate greenhouse gases emissions.

The foundations of FACCE-JPI were established in the discussions carried out through SCAR foresight and collaborative working groups and brought forward through a Franco-British proposal with support of a number of other countries. Today FACCE-JPI includes 24 countries[6] committed to working together to address the common challenges described in this SRA.

What we do

FACCE-JPI has given a strong contribution to the advancement of knowledge in its field. It has encouraged scientists to see agriculture in the wider context of food security and climate change, to explore the links of agriculture to the broader food system and to the broader ecological sphere. It has also accompanied a process of revision of the paradigms that had governed agricultural sciences in the second half of the last century, based on an almost exclusive focus on productivity and on a disregard for soil health, biodiversity, and water consumption.

Up until now, FACCE-JPI has put in place more than 20 research actions that have funded over 120 projects as well as establishing alignment actions and organising workshops. Although FACCE-JPI mobilised nearly €250 millions of funding specifically for the areas of agriculture, climate change and food security between 2011 and 2017, our challenges are as great as ever and so these efforts must be continued and increased in order to achieve the highest impacts and benefits for society.

Where we are going

In the last years, climate change and food and nutrition security have become high-level priorities in the policy agenda both at global and national levels and the need for transformation has been highlighted (see Challenges in food security, agriculture and climate change).

Funding for transnational research is being stretched as numerous demands are being made on the same amount of funding. This is why it is essential that FACCE-JPI sets its priorities and develops its SRA in alignment with national priorities and taking into account developments in the European framework programme.

The lessons learned during the first ten years of FACCE-JPI and the new scientific evidence gathered in this period constitute a solid background for the construction of a new Strategic Research Agenda (SRA) for the next programming period in order to best respond to these challenges as well as to current policy needs.

[6] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Netherlands, New Zealand, Norway, Poland, Romania, Spain, Sweden, Switzerland, Turkey, United Kingdom

Annex 2.
Governance

The FACCE-JPI governance defines the following instances:

Governing Board (GB)
The GB is the decision-making body of FACCE-JPI. The board comprises representatives of all participating countries with the mandate to make (funding) decisions.

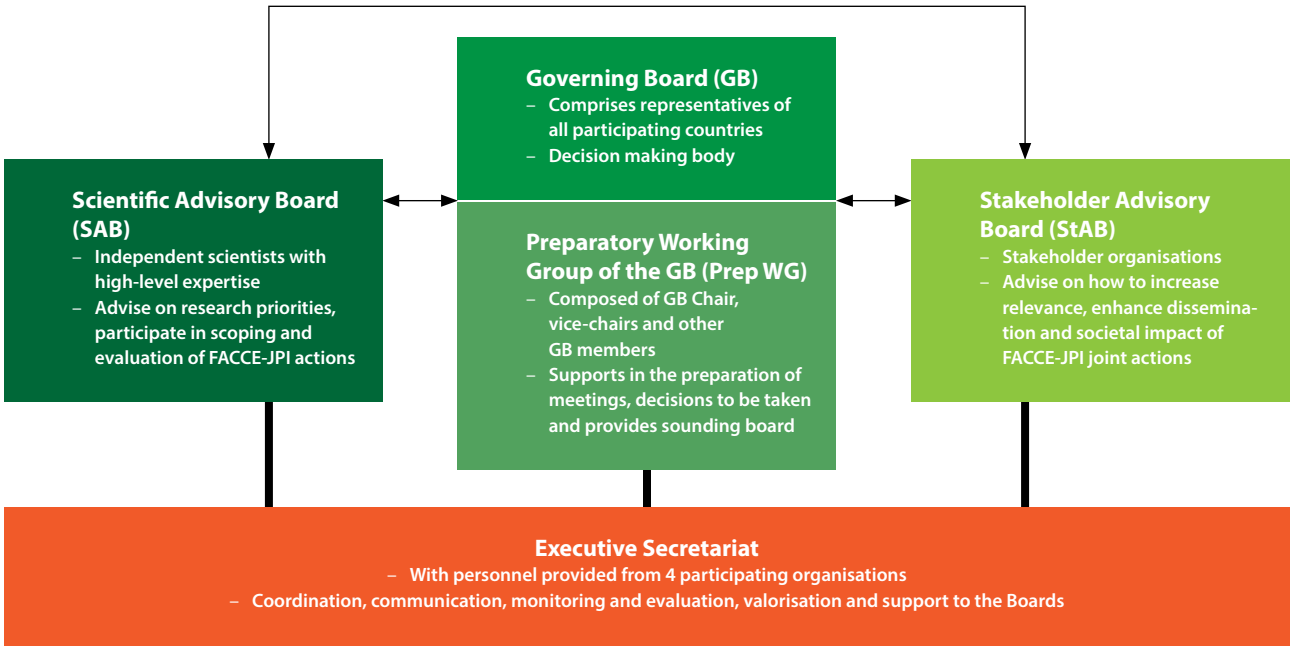
Preparatory Working Group of the GB (Prep WG)
The Prep WG, which emerged from the "Long-term self-sustainability working group" is a permanent body of the FACCE-JPI governance (adopted May 2019) which aims to support the Chairs in their work through preparing GB meetings and the decisions to be taken by the GB and to provide a sounding board for new ideas concerning FACCE-JPI. The members include the FACCE-JPI GB Chair and 2 GB Vice-Chairs and additional GB members who wish to join.

Scientific Advisory Board (SAB)
The SAB consists of 14 independent scientists with high-level expertise across the FACCE-JPI remit. The members are elected by the Governing Board for their outstanding academic record and international reputation. The SAB advises the GB on research priorities for the Strategic Research Agenda, participates in scoping of FACCE-JPI actions, and is involved in the evaluation of the JPI actions. The Joint Research Centre of the European Commission (JRC) also holds a place on the board as an associate member.

Stakeholder Advisory Board (StAB)
The StAB is, composed of up to 22 stakeholder organisations, themselves representing a great number of other regional and national entities working in the food, environment and agricultural sectors. The member organisations are elected by the Governing Board for their capacity to represent different types of end users in line with their role to provide end-user and stakeholder advice to the GB. It advises on ways to increase the relevance of FACCE-JPI's work for stakeholders and suggests ways to enhance the dissemination and societal impact of the joint actions.

Executive Secretariat
The Secretariat supports the three boards' tasks and is responsible for the day-to-day operations of FACCE-JPI.

The FACCE-JPI Secretariat has received financial support from the European Commission in the form of 2 Coordination and Support Actions (2012-2014, 2015-2020) and is currently supported by the participating countries.



Annex 3.
Instruments

Alignment: FACCE has developed several new and innovative instruments for alignment.

Knowledge Hub

The aims of a Knowledge Hub are to increase and facilitate cooperation between excellent researchers and research institutions; bring international impact, develop research capacity, provide learning and training activities and in the long-term to provide efficient scientific support for strategic and political decision-making.

A successful example of this is illustrated in the FACCE-JPI pilot action, the MACSUR Knowledge Hub, which was an innovative, tailor-made instrument associating three complementary dimensions: networking, research and capacity building. The Knowledge Hub is an instrument for alignment, in which many participants are already (nationally) funded to carry out (national) research. Some countries also provided additional research funding. As a follow up to MACSUR, a Knowledge Hub devoted to the science policy interface (SciPol) is being developed to respond to specific policy questions raised by participating members. FACCE-JPI will continue to identify research communities that would benefit from being brought together through Knowledge Hubs.

Knowledge Network

While a Knowledge Hub is based on a combination of new and existing activities and is a restricted scientific community comprising of one consortium focussed on a specific goal, a Knowledge Network consists of a broader expert community. The centre of this community is a Committee of National Science Leads and Funder Representatives, surrounded by an informal web of nodes and interactions, formed by ongoing projects, programmes and various national and international science-policy-practice interactions. The general objectives are to facilitate collaboration across Europe, to increase return on investment of public R&D funding, to create synergy and avoid duplication, and to enable complex research.

Thematic Annual Programming Network

Another instrument is the "Thematic Annual Programming" (TAP) Network. Based on the analysis of existing research and need for alignment across Europe, areas that are common to a number of countries are chosen. Then, in discussion between the national programme managers of interested countries, scientific experts and the SAB, a more specific topic is defined which can be included in a national call. A text is prepared describing the common topic and is included in each national programme participating. Then, once national projects have been selected on this topic, a meeting is organised with all projects working on the given item to discuss objectives, methods and expected outcomes. As part of this coordination, it could be possible to e.g. organise a database of project outputs (to be agreed and planned in advance) funded by the JPI. FACCE-JPI initiated a TAP on Agricultural Soil Quality.

Workshops

FACCE-JPI has carried out a series of workshops focussing on emerging research areas, often at the intersection of two or more established research areas. For example, in 2019, FACCE-JPI organised a workshop on "Phenotyping/ Genotyping and Novel Breeding Techniques for adaptation and mitigation to Climate Change in the livestock sector" and in 2020 one on Urban Agriculture. It is expected that exploratory workshops will give rise to future FACCE-JPI actions.

Calls

Although FACCE-JPI has used a variety of new instruments for implementing its research actions, conventional transnational joint competitive calls, including in ERA-NETs, form the basis of many FACCE-JPI actions. Recently, ERA-NETs have been used extensively, with FACCE-JPI giving rise to five: FACCE ERA-NET Plus, FACCE SURPLUS, ERA-GAS, SusCrop and FOSC. In Horizon Europe, this instrument will cease to be used and a new type of partnership is being developed. FACCE-JPI will continue to put in place EC-independent competitive calls but will also continue to work closely with the European Commission, particularly in the elaboration and implementation of Horizon Europe partnerships.

References

1. FAO (2018) The future of food and agriculture: Alternative pathways to 2050

2. FAO (2017) The future of food and agriculture: Trends and challenges

3. EC (2016) Food 2030: European research & innovation for food & nutrition security

4. IPCC (2019). Climate Change and Land. An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Summary for Policymakers.

5. EASAC (2017). Opportunities and Challenges for Research on Food and Nutrition Security and Agriculture in Europe; https://easac.eu/publications/details/opportunities-and-challenges-for-research-on-food-and-nutrition-security-and-agriculture-in-europe/

6. EUROSTAT Statistics Explained (2015) Land use statistics https://ec.europa.eu/eurostat/statistics-explained/index.php/Land_use_statistics

7. ATF-Plants for the Future Position Paper (2019): http://animaltaskforce.eu/Portals/0/ATF/Downloads/ATF_PlantETP_joint-paper_Sept2019.pdf

8. IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany.

9. EEA (2019). Climate change adaptation in the agriculture sector in Europe. EEA Report No 04/2019. ISSN 1977-8449

10. Campbell B.M. et al. Urgent action to combat climate change and its impacts (SDG 13): transforming agriculture and food systems. Current Opinion in Environmental Sustainability. 34: 13-20 (2018)

11. Vermeulen S.J, et al. Climate change and food systems. Annual Review of Environment and Resources. 37:195-222 (2012)

12. Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. Science, 360(6392), 987-992

13. FACCE-JPI Common Vision (2012)

14. COM(2019) 640 final. Communication From The Commission To The European Parliament, The European Council, The Council, The European Economic And Social Committee And The Committee Of The Regions. The European Green Deal

15. COM(2020) 381 final Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system

16. UN (2015) Transforming our world: the 2030 Agenda for Sustainable Development. A/RES/70/1

17. The Paris Agreement (2015) https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

18. COM (2020) 380 final. Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. EU Biodiversity Strategy for 2030 Bringing nature back into our lives

19. EC (2018) Recipe for change. An agenda for a climate-smart and sustainable food system for a healthy Europe: report of the FOOD 2030 expert group

20. PB. Joly, M. Matt (July 2017). Towards a new generation of Research Impact Assessment approaches. Journal of Technology Transfer, 1-11. DOI: 10.1007/s10961-017-9601-0.

21. OECD Science, Technology and R&D Statistics: Main Science and Technology Indicators