



Self-Evaluation of FACCE-JPI 2010-2019:

**Alignment of National and European Research Programmes
and
High Quality Transnational Research Activities**

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Author's note

The information set forth herein has been obtained by the author and is believed to be reliable. The views and opinions expressed herein are those of the FACCE-JPI Governing Board and of the author. The latter are based on statements given by the FACCE-JPI Governing Board or on data obtained during the monitoring and evaluation work.

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1. Executive Summary

This report is the outcome of the second cycle of evaluation as recommended in the FACCE-JPI framework on Monitoring and Evaluation. It comprises an analysis of the progress towards alignment of national and European research programmes as well as the first assessment of FACCE-JPI's scientific outputs with regard to high quality transnational research.

The evaluation consists of an analysis of Governing Board member countries' responses to a survey performed over the summer of 2019 and its comparison with the previous responses given in 2016, supplemented by a bibliometric analysis of scientific articles published by FACCE-JPI funded researchers as well as by additional data held by the Secretariat.

The evaluation revealed **increased alignment of national and European research programmes** as well as **excellent scientific performance** of FACCE-JPI's research activities:

- ✓ There is **greater impact of FACCE-JPI's research strategy on national research programmes** as a larger number of Governing Board members assume that its influence will rise within the next five years.
- ✓ The number of member countries indicating that **FACCE-JPI's Strategic Research Agenda was taken up into national research programmes** increased.
- ✓ FACCE-JPI's **research strategy reflects national priorities** as continuously confirmed by Governing Board members.
- ✓ The initiative's **actions are increasingly relevant** to member countries and Governing Board members are **more and more satisfied with the outputs** of FACCE-JPI.
- ✓ There is **constant appreciation of FACCE-JPI's joint actions**, this time with a greater acknowledgement of joint calls and exploratory activities.
- ✓ FACCE-JPI supports **capacity building, training and career development** of young scientists as indicated by a large number of jobs created and by the stated professional future of researchers.
- ✓ More than **600 articles** have been published by researchers funded through FACCE-JPI with a **citation performance rate of 41% above average** indicating the **very high scientific quality** within the initiative's remit.
- ✓ There is **strong global perception** of FACCE-JPI's research as well as solid **transnational collaboration** within the FACCE-JPI community but also with scientists from the USA, Australia, China and Canada.

There is, however, **room for improvement** and several issues need **renewed attention**:

- **National ownership and high-level agreements** should be reinforced as member country representatives stated little improvement.
- **Decision making processes** were rated somewhat less effective by Governing Board members and **attendance at meetings** declined.
- The upcoming European framework programme 'Horizon Europe' causes many uncertainties and might affect **member countries' participation in future joint actions**.
- Although more funding for research might be available in the future, a **tendency towards greater investment at national level** is noticeable.

- Governing Board members saw only little progress towards the **inclusion of international partners**.
- Perhaps most importantly, Governing Board members see little advancement with regard to the **communication of the initiative's outcomes and impact**.

Consequently, a number of **recommendations and suggestions** emerged from the evaluation that should be discussed and validated by the Governing Board:

- It might be worth discussing how far the decreased attendance in Governing Board meetings is only temporary or if alternatives to **physical attendance at Governing Board meetings** should be considered.
- The Governing Board should reconsider the recommendations from the report from the FACCE-JPI Working Group on National Ownership to **reinforce national ownership and strategic alignment**.
- Member countries' **interest and engagement** in FACCE-JPI need to be monitored as the forthcoming framework programme '**Horizon Europe**' causes uncertainties amongst member countries. The tendency towards more available funding with an increased interest in supporting national research indicates the need for further discussion on how **investments** into FACCE-JPI joint actions should be made.
- Research projects of joint actions already collaborate greatly with non-FACCE-JPI and non-European countries and FACCE-JPI's research is acknowledged globally. FACCE-JPI's mission to tackle a global societal challenge could benefit by promoting the inclusion of **international partners** in a targeted and selective way as also desired largely by member country representatives.
- Governing Board members should discuss if relatively **neglected call topics** concerning a) specific research topics as for instance 'pests and diseases' or 'methodologies to quantify GHG emissions and removals' as well as b) policy, societal and economic aspects should be addressed further and how.
- With regard to **FACCE-JPI's visibility**, it is important to **advance the communication** between funding partners of existing and future joint actions with FACCE-JPI to increase researchers' willingness and compliance to **acknowledge FACCE-JPI** in related outputs and outcomes, especially their scientific publications.
- There is great desire to increase FACCE-JPI's visibility by better **communicating the initiative's outcomes and impacts** that in turn will probably improve national commitment to actions. Addressing this need will have high priority by the new Secretariat as already outlined in its biannual work plan.

2. List of Abbreviations

4PRIMA	PRIMA (Partnership for Research and Innovation in the Mediterranean Area) Coordination and Support Action
AgMIP	Agricultural Model Intercomparison and Improvement Project
Belmont Forum Call	FACCE-JPI and Belmont Forum launched a Joint Call on 'Food Security and Land Use Change' in 2013
BiodivERsA Call	BiodivERsA ERA-NET and FACCE-JPI launched a joint call on 'Promoting synergies and reducing trade-offs between food supply, biodiversity and ecosystem services' in 2013
EJP Cofund	European Joint Programme Cofund
EJP SOIL	European Joint Programme Cofund on Soil
ERA	European Research Area
ERA-GAS	FACCE ERA-NET Cofund for monitoring & mitigation of Greenhouse gases from agri- and silvi-culture
ERA-NET	European Research Area Network
ERA-NET+	FACCE ERA-NET+ on Climate Smart Agriculture
FACCE ERA-NET+	See ERA-NET+
FACCE ERA-GAS	See ERA-GAS
FACCE SURPLUS	See SURPLUS
FACCE-JPI	Joint Programming Initiative on Agriculture, Food Security and Climate Change
FNS	Food and Nutrition Security
FOSC	ERA-NET Cofund on Food and Nutrition Security
GB	Governing Board
MITIG	Multipartner call on Greenhouse Gas (GHG) mitigation in 2013
ICT	Information and Communications Technology
ICT Agri ERA-NET	ERA-NET Cofund on ICT and robotics for sustainable agriculture
INIA	National Institute for Agricultural and Food Research and Technology, Spain
INRAE	National Research Institute for Agriculture, Food and Environment, France
IP	Implementation Plan
JIF	Journal Impact Factor
JPI	Joint Programming Initiative
JUELICH	Project Management Jülich, Germany
KH	Knowledge Hub
KH FNS	Knowledge Hub on Food and Nutrition Security
KNSI	Knowledge Network on Sustainable Intensification
MACSUR	FACCE-JPI Knowledge Hub on Modelling European Agriculture with Climate Change for Food Security
Mio	Million
SAB	Scientific Advisory Board
SCAR	Standing Committee on Agricultural Research
Sci-Pol	Science Policy Knowledge Hub following MACSUR
SD	Standard Deviation
SRA	Strategic Research Agenda
StAB	Stakeholder Advisory Board
SURPLUS	ERA-NET Cofund on Sustainable and Resilient agriculture for food and non-food systems
SusAn	ERA-NETwork on Sustainable Animal Production Systems
SusCrop	SusCrop-ERA-NET, Cofund on sustainable Crop Production
TAP Soil	Thematic Annual Programming on Soil
UKRI-BBSRC	UK Research and Innovation - Biotechnology and Biological Sciences Research Council, United Kingdom
WaterWorks 2015	ERA-NET Cofund WaterWorks2015 is a collaboration between FACCE-JPI and Water JPI and launched a joint call in 2016
WoS	Web of Science
WR	Wageningen University & Research, The Netherlands

3. Introduction

This year (2020) marks 10 years of FACCE-JPI. Guided by its Strategic Research Agenda (2012, updated 2016) and driven by its vision and mission, the initiative seeks to align and foster new research at the intersection of agriculture, food security and climate change. In 2016/17, the JPI was evaluated with regard to its progress towards its goals of aligning and integrating national and European research programmes, the efficiency of its processes, the relevance of its actions, the commitment of the member countries and the future expectations for FACCE-JPI. This **evaluation was repeated in 2019** to assess the **advancement of FACCE-JPI** in this context. Furthermore, launched research activities are at a stage to provide first **scientific results**, which can be evaluated with regard to their **high quality and their impact on the scientific community**. In order to achieve the evaluation of both aspects, the FACCE-JPI Secretariat has a dedicated activity to implement the work outlined in the FACCE-JPI Evaluation Framework¹, which was adopted by the Governing Board (GB) in October 2013.

3.1 FACCE-JPI Evaluation Framework

The FACCE-JPI Evaluation Framework¹ was the result of an analysis of procedures and tools for the monitoring and evaluation of the alignment processes and joint actions launched by FACCE-JPI. The framework provides guidelines for monitoring and evaluation processes and identifies the following three targets for the evaluation of FACCE-JPI:

- **Target 1:** to improve the alignment of national and European research programmes
- **Target 2:** to increase high quality transnational research activities within food security, agriculture and climate change
- **Target 3:** to improve the societal impact on the challenge of food security, agriculture and climate change

For each of these targets, the framework recommended indicators to address evaluation objectives and criteria. These have been subsequently updated and modified by the FACCE-JPI Monitoring and Evaluation team. In terms of implementation, the framework recommended three cycles of evaluation, the first focuses on the evaluation of Target 1, which was conducted in 2016/17. The second cycle aims to assess the progress towards Target 1 after a certain period as well the quality of transnational research activities. This report outlines the results of the second cycle. The third cycle (the evaluation of societal impacts) will be carried out at a later date.

¹ https://www.faccejpi.net/en/show/FACCE-JPI - Monitoring_and_Evaluation_Framework_Final_draft_v_3.pdf.htm

4. Methodology

The primary evidence used in this report was gathered from three main sources: firstly, from responses to a survey sent to FACCE-JPI Governing Board (GB) members, secondly, from a bibliometric study conducted by JUELICH and thirdly, from data held by the FACCE-JPI Secretariat.

4.1 Survey to Governing Board members

The survey to GB members was developed based on the previous questionnaire, which was sent to FACCE-JPI member representatives in 2016, itself based on a draft version of the FACCE-JPI Evaluation Framework. A section was added asking whether there was noticeable improvement. The survey comprised a range of topics for which GB members were asked to provide a **score** from a given scale (see below) indicating the extent to which they agreed with a statement or to which they found a given issue important (either for their own country or for FACCE-JPI as a whole). This was supplemented with **free-text answers** where GB members could elaborate on their score or provide specific examples or opinions. The survey was provided to GB members via Survey Monkey in March 2019, with responses completed by September 2019.

FACCE-JPI member countries with two members were given the opportunity to complete the survey on an individual basis, or jointly with the other GB member from their country. For all countries with two GB members, joint responses were provided. Responses were received from all but three countries, giving a **response rate of 87.5%** (21 responses).

For those questions in the survey with a scaled response, FACCE-JPI member countries were asked to assign an extent to which they either agree with a statement or assess the level of importance they associate with a given issue ('not at all', 'very small extent', 'small extent', 'moderate extent', 'large extent', 'very large extent'). Comparable with the previous evaluation, the 'large extent' and 'very large extent' categories have been combined to indicate the **degree of positivity**. 'Moderate extent' is also considered a positive response; however, it was not included in this grouping to allow a better differentiation between questions. Bar diagrams compare raw responses given in 2016 with those in 2019. The increase or decrease in percent of positive answers is displayed in the same figure. For the analysis of other categories, the corresponding text will provide additional context. It should be noted that differences are most probably not statistically significant due to the small sample number (=number of responses). However, even non-statistically significant and small changes can indicate a trend in the analysed category.

4.2 Bibliometric Analysis

Bibliometrics is the statistical analysis of a written document. It is frequently used in research management and evaluation to support decision-making. It measures scientific outputs and scientific impacts by applying quantitative indicators. The standard source of information for a bibliometric analysis is the database Web of Science² (WoS) which covers over 90 million records and associated citation references. For the bibliometric analysis of FACCE-JPI the Web of Science-Core

² <https://apps.webofknowledge.com> by Clarivate Analytics

Collection³ has been used. The search query⁴ looked for publications acknowledging FACCE-JPI, MACSUR or WaterWorks2015 in the time frame 2010 to June 2019, with the first publication identified in 2013. This search is associated with certain limitations: articles not acknowledging the applied search terms will not be found. For instance, an article citing Water-JPI but not FACCE-JPI or WaterWorks2015 will not emerge in the publication list, although this project might have been funded by the joint action. In total, 600 publications were found including all types of scientific publications (for instance books, conference papers and essays), whereas the bibliometric analysis focuses primarily on publications in journals (591 articles, reviews and proceedings papers). Details on the analysis can be found in the corresponding figure legend or text or in the annex, section 8.

4.3 Supplementary data

A great proportion of the analysis of this report is based on the responses to the GB survey and on the bibliometric analysis. However, there are certain indicators which require additional data held by the FACCE-JPI Secretariat or Call Coordinators of joint actions. Such information concerns GB meetings, participation in FACCE-JPI actions, financial data as well as general call and project data (e.g. call topics, start dates, data stated in mid-term or final reports). Again, it should be noted that data analysis greatly depends on the availability of data and thereby on the willingness of Call Coordinators to share these data, as well as on the researchers' compliance in providing (correct) answers to questionnaires. Moreover, quality and coherence of data play an important role as discrepancies in data format exist due to diverse data collection methodologies of joint actions. As a consequence, the analysis often focuses on a certain group of joint calls to ensure the comparability and accuracy of the evaluation.

Generally, the individual methodology is explained in the corresponding section or figure. Further information on some indicators and methodologies can also be found in the annex, section 8.

³ The Web of Science Core Collection of Forschungszentrum Jülich GmbH comprises the following citation indices: Science Citation Index Expanded (SCI - Expanded), Social Science Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), Conference Proceedings Citation Index - Science (CPCI - S), Conference Proceedings Citation Index - Social Science & Humanities (CPCI - SSH), Book Citation Index- Science (BKCI - S), Book Citation Index – Social Sciences & Humanities (BKCI - SSH), Emerging Sources Citation Index (ESCI), Current Chemical Reactions (CCR - EXPANDED), Index Chemicus (IC).

⁴ (FT=(FACCE OR MACSUR) NOT (FT=(FACCER AND FACCENT)) OR (FT=WATER WORKS 2015) OR (FT=WATERWORKS 2015) OR (FT=WATERWORKS2015))

5. Results and analysis of Target 1: Alignment of national and European research programmes

This chapter provides an analysis of data gathered through the GB member survey conducted in 2019 and from data held by the FACCE-JPI Secretariat.

The GB member survey was sent to the 24 countries currently represented in the FACCE-JPI GB. Responses were received from all but three countries, giving a response rate of 87.5%. Not all questions were answered by every respondent; the number of countries responding to a given question is provided in the appropriate figure legend.

5.1 Organisation and decision making

FACCE-JPI's governance is composed of three boards: the Governing Board (GB), which is the decision-making body of the JPI, advised by a Scientific Advisory Board (SAB) and a Stakeholder Advisory Board (StAB). All three bodies are supported by the Secretariat, whose members are distributed in a number of countries. In general, GB members seem to be satisfied with the overall decision making progress in FACCE-JPI ("To what extent do you agree that FACCE-JPI has established efficient decision making processes": 52% responded positively⁵; Figure 1). GB meetings were highlighted in the majority of responses, with emphasis on the preparation before and after but also on the timely dissemination of information (10 citations). The latter allows decision-makers to consult their national organisations ahead of time. GB meetings were seen as an opportunity to share and exchange on members' views, an important tool to align strategies. Further areas include the development of the Strategic Research Agenda (SRA) and Implementation Plans (IP) (5 citations), actions and calls (MACSUR II, FACCE ERA-NET+, EJP SOIL; 3 citations), the work by the self-sustainability group (3 citations), and working with the European Commission (2 citations).

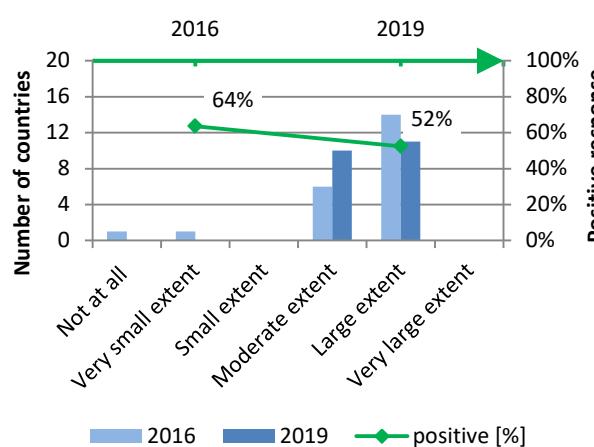


Figure 1: Extent that FACCE-JPI has established efficient decision making processes (bars: number of countries; 2016: n=22, mean=3.41; 2019: n=21, mean=3.52; green diamonds: percent positive responses for 2016 and 2019)

Despite a high level of satisfaction with the overall decision making processes, the number of positive responses decreased by 12% compared to the survey in 2016. This is explained by the fact that the rating shifted towards 'moderate extent', which is not considered in the calculation of positive responses (see methodology, section 4). In contrast to the responses given in 2016, GB members agreed to at least a moderate extent that FACCE-JPI has established efficient decision

⁵ A positive response is defined as either agreeing to a large extent or a very large extent (see methodology).

making, resulting in an increased mean value when compared with the previous survey (2019: 3.5 versus 2016: 3.4). In addition, an improvement of GB meetings since 2016 has been confirmed by 60% of GB members (see Figure 12, page 28), indicating a general positive attitude towards the organisational process.

With regard to communications, GB members agreed that they receive enough information about on-going joint actions (81% responded positively; Figure 2), which is comparable with the result of the previous evaluation report. The better format of IP action updates and minutes was acknowledged, the latter being better structured and including a useful action list.

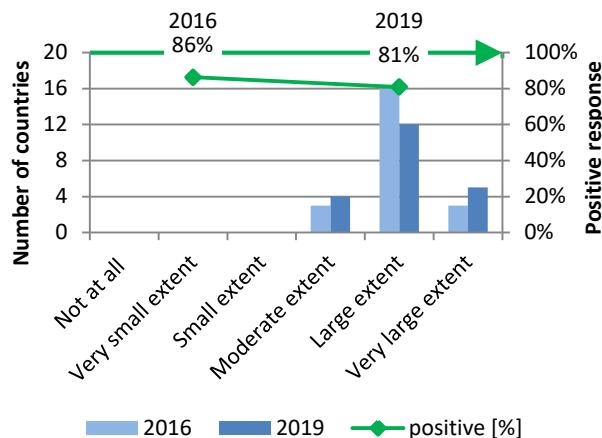


Figure 2: Extent that GB members receive enough information about on-going FACCE-JPI actions (bars: number of countries; 2016: n=22, mean=4.00 2019: n=21, mean=4.05; green diamonds: percent positive responses for 2016 and 2019)

Already described as a successful approach with regard to decision making and organisation (see above and Figure 1), the processes for developing the SRA and IPs have been seen largely as effective and efficient (75% of GB members responded positively; Figure 3).

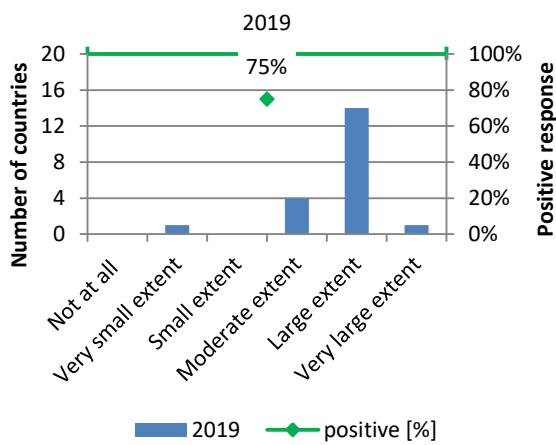


Figure 3: Extent that GB members agree that the processes to develop the SRA and IPs are effective and efficient (bars: number of countries; 2019: n=20, mean=3.7; green diamond: percent positive responses for 2019)

5.2 Commitment of FACCE-JPI member countries

The commitment of FACCE-JPI member countries can be measured at a number of levels through a range of indicators. At the Joint Programming level, this can be measured through the retention of member countries in the JPI and sustained participation in GB meetings. Commitment can also be demonstrated through participation in the joint actions launched by the JPI, and through hosting high-level JPI meetings (e.g. GB meetings).

5.2.1 Governing Board

The commitment of FACCE-JPI member countries can be measured through different indicators. Firstly, since FACCE-JPI was launched, only one member country has dropped out of the GB. On the contrary, the membership has expanded since 2016 to include New Zealand as an Associate Member, as well as Hungary, Latvia and Lithuania as full members, bringing the number of countries involved from 21 to 24.

To further quantify commitment, the attendance of these countries in the triannual FACCE-JPI GB meetings can be measured (Figure 4). Compared with the previous report, which evaluated the attendance from the start of FACCE-JPI till 2016, the average participation of FACCE-JPI member countries dropped from 82% to 77% for the period 2017-2019. This decline was already visible at the end of the last evaluation period (years 2015-2016).

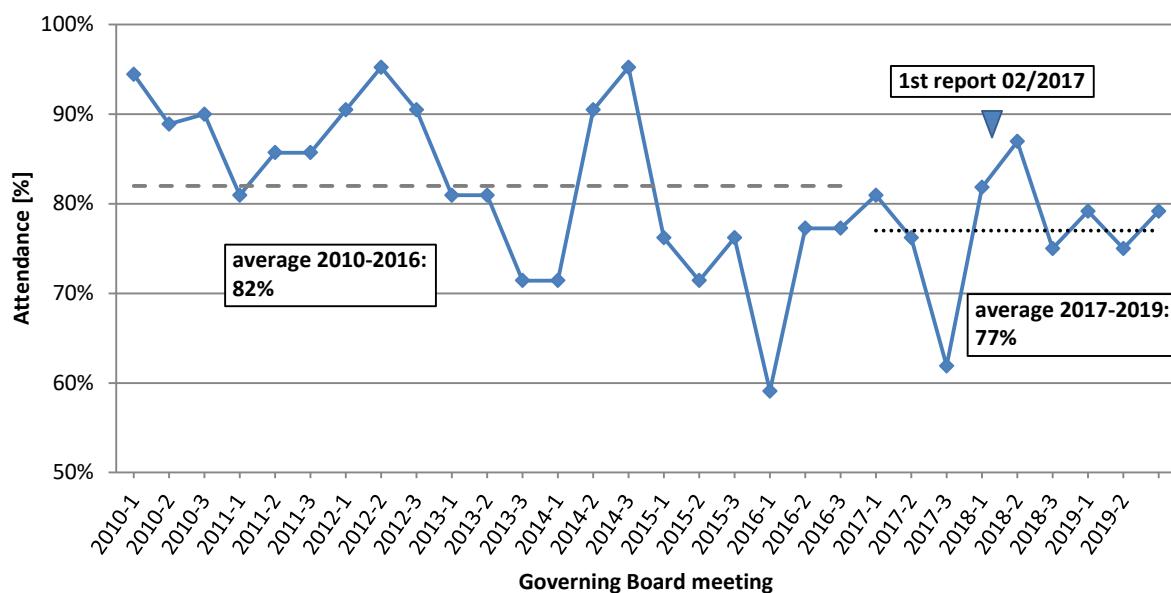


Figure 4: Percentage attendance of FACCE-JPI member countries at GB meetings (percentages displayed are based on whether each country was represented, and do not take into account the *number* of representatives each country has on the GB.)

A further indicator of commitment is the willingness to host high-level JPI meetings, i.e. GB meetings. If New Zealand is excluded based on the geographical impracticality of hosting a meeting outside Europe, 65% of the 23 European member countries have hosted meetings with two of the new member countries having volunteered to host upcoming meetings, leaving six European countries yet to host. This shows a good level of engagement across the member countries.

5.2.2 Participation in joint actions

Consistent participation in FACCE-JPI meetings is one demonstration of commitment by the member countries. However, the JPI could not be considered successful if there were insufficient interest from the member countries in the actions that it launches. Table 1 shows FACCE-JPI member countries participation in each of the joint actions launched since the beginning of FACCE-JPI,

comprising joint calls as well as alignment actions such as the Knowledge Hubs MACSUR and Food and Nutrition Security (FNS), the Knowledge Network on Sustainable Intensification (KNSI) and the Thematic Annual Programming on Soil (TAP SOIL). FACCE-JPI actions operate with a variable geometry, with each member country participating in the actions most relevant to them. In some circumstances, a member country may participate with a confirmed budget in a joint call but not ultimately fund any of the selected projects. This is usually due to all applicants from these countries being too low down the externally-evaluated ranking list of proposals to be funded. Therefore, and also comparable with the previous report, participation in joint actions by member countries is still recorded as commitment even if no project could be funded (marked with a zero value in Table 1).

At the joint action level, participation by member countries varies from 38% in the joint FACCE-JPI/Belmont Forum call on land use change, the third FACCE SURPLUS call and the Knowledge Hub on Food and Nutrition Security, up to 86% for FACCE ERA-NET+ on Climate Smart Agriculture. Average participation is 58% (down from 64% for FACCE-JPI's first seven actions analysed with the former report). The average number of actions each country participates in is 8.56 out of all 17 actions launched by the end of 2019, considering only actions during membership. (The participation rate increases to 8.76 out of 17 when all member countries are considered in spite of not being a FACCE-JPI member at the time of the action.)

Overall, there is good commitment from the majority of member countries, both in terms of sustained membership in the JPI and participation in GB meetings. As already noted with the previous report in 2017, there is a slight decline over time for the participation in GB meetings. Similarly, there is good overall participation in each of the actions considered by this evaluation. Some of the barriers to participating in actions are explored in the following sections.

Table 1: Member country participation in FACCE-JPI actions (joint calls and alignment actions). Some of the joint actions also had participation by non-FACCE countries, but these countries are not included in the table. Note: where 0 is displayed, a country has participated in a call but has either not funded any projects, or contributions are in kind. These are included in calculations for participation. Percentage participation for each action is based on the actual number of member countries at the time of the action. Numbers in brackets indicate the amount of countries joining an action (Σ top row) regardless of the status of membership at that date.

Country	MACSUR1	2012		2013			2015			2016		2017		2018		2019	
		Multipartner call on GHG mitigation	Belmont Forum call	ERA-NET+	BiodivERsA call	MACSUR2	SURPLUS-1	TAP SOIL	KNISI	WaterWorks 2015	ERA-GAS	SURPLUS-2	SusCrop	ERA-GAS-2	SURPLUS-3	KH FNS	FOSC
Participation [%] -->	81%	52%	38%	86%	52%	76%	62%	43%	43%	68%	59%	48%	74%	83%	38%	38%	42%
No Σ	17	11 (12)	8	18	11 (12)	16	13 (14)	9	9	15	13 (14)	10	17 (18)	19	9	9	10
AT	X				X	X						X					
BE	X	X		0	X	X	X			X		X	0	X	X	X	0
CH		X	X		X	X											
CY		0	0	X	0			X									
CZ	X			X		X										0	
DE	X	X		X	X	X	X	X		X	X	X	X	X	X	X	0
DK	X			X		X	X		0	X	X	X	X	X	X	X	0
EE	X			X		X						X	X	0	X		
ES	X	X		X	X	X	X	X	0	X			X	0			
FI	X	X		X		X	X	X	0	X	X	X	X	0			
FR	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X	X	0
HU													0				0
IE		X	0	0				X	0	X	X		X	X		0	0
IL	X		0	X													
IT	X	X		X		X	X	0					X	X		X	0
LT				0										X	X	X	X
LV																	
NL	X		0	X	X	X	X	X	0	0	X	X	X	X			
NO	X			0	0	X	X	X	0	X	X	X	X	X		X	0
NZ		X					X				X		X	X			
PL	X		0	0	X	X	0	X		X	X	X	X	X	X		
RO	X	0	0	X	X	X	X			X	X	X	X	X	0		
SE	X			X	X	X				X	X		X				0
TR				0						X	0	0	X				0
UK	X	X	X	X	X	X	X	X	X	X	0	X	X	0			0

5.2.3 FACCE-JPI's investment into joint actions

Since its beginning, FACCE-JPI has launched a number of actions using a variety of instruments to accomplish its Implementation Plans. Between 2011 and mid-2019 member countries budgeted over 90 Mio€ to actions granting projects with over 118 Mio€ (Figure 5a, 'Call budget (FACCE)' and 'requested grant (FACCE)', excluding investments into TAP SOIL, KNSI, the joint call of FACCE ERA-GAS with the ERA-NETs SusAn and ICT Agri, as well as actions, which have not selected projects at the time of the analysis). Altogether, funded FACCE-JPI research projects are worth over 187 Mio€ taking into account in kind contributions by grant holders and contributions by third, non-FACCE-JPI countries (Figure 5a, 'Total costs (all countries)'). Comparing FACCE-JPI investments into projects (=requested grant) with the entire total costs of projects (including third, non-FACCE countries) results in an amplification of FACCE-JPI's financial investments of almost 160% for all funded projects at the end of 2019.

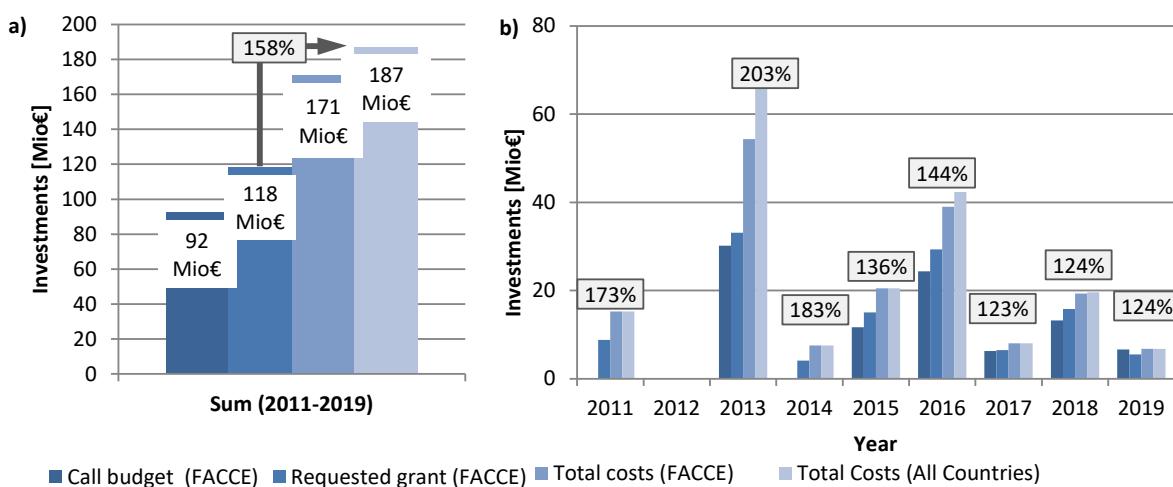


Figure 5: FACCE-JPI investments into research projects over time. Shown are budgeted amounts to calls ('Call budget (FACCE)'), amounts requested by researchers of selected projects ('Requested grant (FACCE)'), total costs of selected projects ('Total costs (FACCE)') for FACCE-JPI member countries and total costs of selected projects including third, non-FACCE-JPI countries ('Total Costs (All Countries)'). Grey boxes display the amplification rate of FACCE-JPI's investments as calculated by comparing FACCE-JPI investments into projects ('Requested grant (FACCE)') with the entire total costs of projects ('Total Costs (All Countries)'). Calculations are based on all actions from 2010 until mid-2019 with running projects, excluding TAP Soil, KNSI, the joint call of FACCE ERA-GAS with the ERA-NETs SusAn and ICT Agri, as well as actions, which have not selected projects at the time of the analysis.

When analysing investments into FACCE-JPI research projects per year, 2013 was the year with the highest financial activities in the given period (Figure 5b). The years 2011-2014 were the years with the highest amplification of financial investments by FACCE-JPI member countries. This does not come as a surprise considering the fact that the actions launched during this period were the actions with the largest multiplication effects: On the one hand this period comprises calls with high international orientation (Multipartner call on GHG mitigation in 2013 and the joint call with the Belmont Forum in 2013) which benefit from large investments of non-FACCE-JPI countries. For example FACCE-JPI countries invested about 4.3 Mio€ into projects of the Multipartner call on GHG mitigation, whereas total projects costs of all partners (including non-FACCE-JPI countries) sums up to 8.6 Mio€ resulting in an almost two-fold multiplication of FACCE-JPI investments. The amplifying effect is even higher for the joint call with the Belmont Forum since FACCE-JPI's participation in

successful projects is quite low (only three countries are involved in this action). On the other hand, this period comprises the launch of the two phases of the Knowledge Hub MACSUR (2011 and 2014). In addition to in-cash funding by FACCE-JPI member countries this kind of action mobilises in-kind funding by grant holders (e.g. salaries, in the end paid by respective countries) resulting in an 1.8 fold amplification of FACCE-JPI investments.

The investments into alignment actions TAP Soil and KNSI are difficult to calculate, since they do not primarily focus on bringing in new money, but rather on using existing funding more effectively. Member countries joining TAP Soil are requested to provide financial resources for networking and travelling for participating researchers. It was agreed to allocate 7-10% of the total project budget to the TAP Soil networking activities. Assuming an average of 10 k€ allocated for each TAP Soil project (13 by now) 130 k€ have been provided by participating countries. Members of the KNSI committee (funders, policy makers, research groups and other stakeholders) are expected to contribute expertise and knowledge in kind; hence, no concrete financial data exists. Further information on alignment actions can be found in section 5.4.1.2 Alignment activities, p.22.

5.3 Strategic alignment

FACCE-JPI's main strategic document is the Strategic Research Agenda (SRA), developed by the three boards and the Secretariat, and adopted by the GB. There have been two versions published (2012 and 2016) and an updated document with new research priorities is in preparation for publication in 2020. FACCE-JPI puts its SRA into practice through successive Implementation Plans (IPs). To date, there have been three IPs (covering 2014-2015, 2016-2018 and 2019-2020) and a fourth one is in preparation to accompany the new SRA in 2020. IPs describe specific actions that the JPI will launch to address priorities in the SRA.

In order for FACCE-JPI to deliver its objective to align national research programmes, its SRA needs to reflect national priorities and is supposed to have influence at the national level. The process of developing the SRA and corresponding IPs needs to be inclusive to ensure maximum buy-in at the national level before the development of any specific actions.

More than 60% of GB members reported that the SRA **reflects the priorities of their country**, which is comparable with the former report (Figure 6a; 65% responded positively). As the JPI tackles a societal challenge affecting all countries, priorities covered in the SRA match national priorities usually quite well. An example of where the SRA does not reflect national priorities is where there are regional aspects specific to individual countries. It was pointed out that while the SRA does not always matches a country's specific priority, at least the focus of the ministries involved in FACCE-JPI was represented. Topics such as digitalisation, circularity in agriculture and the connection between enterprises and research were mentioned as key research areas that are not addressed by FACCE-JPI's SRA.

When asked to **identify in which Core Themes alignment of research strategy had been especially effective**, Core Themes 4 and 5 (Adaptation to Climate Change and Mitigation of Climate Change) were highlighted most commonly (6 and 4 citations, respectively). Core Themes 1, 2 and 3 were stated only one time each, whereby KNSI and TAP Soil (both Core Theme 2) were mentioned explicitly with regard to their potential that was not met due to the lack of sufficient funding. Core

Themes 1 and 2 have been mentioned more commonly in the survey in 2016, but a reason for the decline remains unclear. The evaluation report of 2017 recommended to further ***advance Core Theme 3*** in order to better address this part of the SRA. When asked to rate the improvement in this regard, only 32% of GB members agreed (see Figure 12, page 28). The collaboration with BiodivERsA was mentioned positively in this regard, also indicating that further effort going beyond this partnership might not be necessary. It might be worth mentioning that FACCE-JPI adapted its Core Themes in 2020 taking into account the new European framework programme ‘Horizon Europe’, which foresees new options for partnerships and contributions to missions.

The ***extent to which the SRA has influenced the focus of national research programmes*** varies considerably across the member countries ranging from having no influence at all through to having a large influence (Figure 6b). The percentage of countries responding positively increased from only 9% in 2016 up to 26% in 2019 which is due to the fact that five countries reported a large influence of the SRA on the focus of their national programmes compared to only two in the previous report. Two countries stated two-fold higher influence of the SRA on their national programmes, which is balanced by three countries downgrading their rating comparably. The majority of members (63%; 12 out of 19 responses) indicated a level of influence similar to their response to the previous questionnaire.

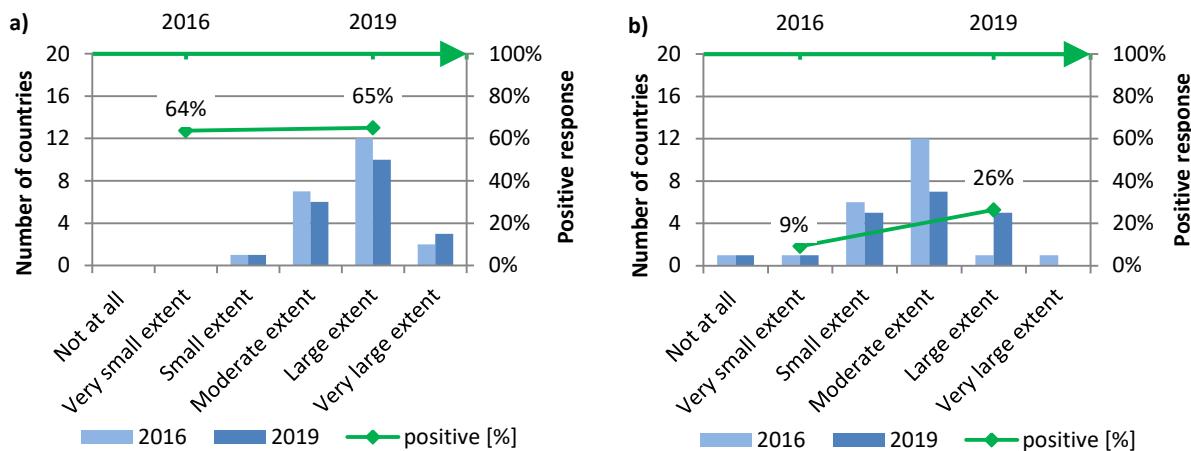


Figure 6: a) The extent that the SRA reflects national priorities b) The extent of Influence of FACCE-JPI SRA on the focus of national programmes (bars: number of countries; a) 2016: n=22, mean=3.68 2019: n=20, mean=3.75; b) 2016: n=22, mean=2.64; 2019: n=19; mean=2.74; green diamonds: percent positive responses for 2016 and 2019)

Examples of where the FACCE-JPI SRA has had most influence include: One country used FACCE-JPI’s SRA as an important source when setting priorities for a new policy in the Department of Agriculture and Fisheries. Another country stated that the document had direct influence on the national research programme, depending on its level of implementation. Lastly, one country stated that the document has influenced work on greenhouse gas mitigation. Other countries’ responses referred to the SRA playing an important role in prioritising national level engagement especially in joint calls at an early stage (4 citations).

When asked to identify the ***main obstacles to the adoption of the FACCE-JPI SRA into national research programmes***, a number of themes emerged from GB member responses, which were

relatively similar to the difficulties reported in 2016. Again, the most common statement (6 responses) was that there is either no specific national strategy or programme in the FACCE-JPI remit or that national strategies/programmes do not closely map to FACCE-JPI priorities. This was followed by a lack of visibility or understanding of JPIs and/or FACCE-JPI's SRA at the national level with lack of human resources and budget cited as reasons (4 responses). Two member countries indicated that regional aspects and national foci will define the degree of uptake, and finally the intersection of Food Security, Agriculture and Climate Change was seen as a possible limitation for the impact of FACCE-JPI's SRA on national programmes, being considered too narrow (1 citation).

Similarly to the reactions to the 2016 survey, suggestions by members to ***overcome these barriers*** include better coordination at the national level, more sharing of information, plus allying with wider international initiatives (e.g. Global Research Alliance). The development of specific national strategies for joint programming was not mentioned any longer.

As previously, these barriers and options to overcome them closely mirror the outcome of the FACCE-JPI Working Group on National Ownership (itself set up in response to the IDDR report⁶), which made the following recommendations to the FACCE-JPI GB (May 2016):

- Inspire/empower functional structures that support national ownership for joint programming
- Enhance and promote dissemination of FACCE-JPI activities and results at the national level, including the highest political level

The first evaluation report of 2017 asked the GB to reconsider these recommendations in order to further advance strategic alignment. When asked ***how far functional structures have been inspired*** and ***how far high-level agreements have been achieved*** only 20% and 25% responded positively (mean=2.7 each; see Figure 12, page 28). This comes along with GB members stating deficits in the communication of outcomes and impact (only 20% responded positively, mean=3.0, see Figure 12, page 28). Proper dissemination of FACCE-JPI's results is considered as a key factor to improve FACCE-JPI's visibility at a high political level, eventually resulting in improved national commitment. Further suggestions for improvement include the reiteration of the role of delegations at GB meetings and in decision-making procedures as well as the establishment of mirror groups at national level.

53% responded positively concerning the extent to which GB members consider ***FACCE-JPI's contribution to avoid duplication and filling gaps between member countries*** (Figure 7). This is an increase of almost two-fold when compared to the first report on alignment in 2017. Again, ERA-NETs and other calls were highlighted as key activities with regard to filling gaps between FACCE-JPI countries. The initiative's ability to mobilise funding on topics, which would be too narrow for single countries, or on topics that are best addressed in a more global or transnational perspective (e.g. EJP SOIL, SusCrop) has been highlighted as a key element in advancing research in the remit of FACCE-JPI. On the other hand, it was noted that actions which focus on alignment still lack resources and are much harder to manage and sustain. Also the lack of concrete indicators to measure the level of

⁶ "Retrospective Look on the First Three Years of FACCE", S. Treyer and M. Brun, IDDR

duplication and gap filling was mentioned as making it hard to estimate the extent of success in this regard (1 citation).

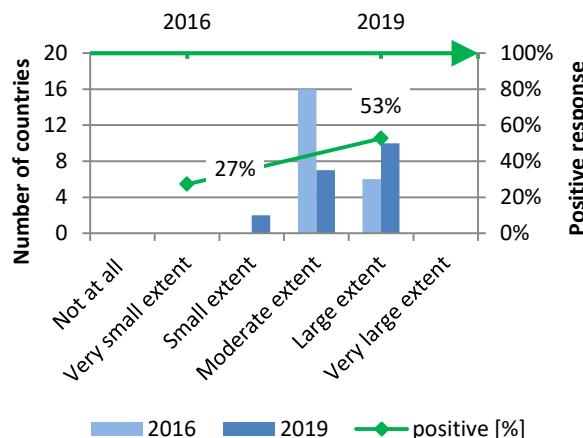


Figure 7: Extent of FACCE-JPI avoiding duplication and filling gaps (bars: number of countries; 2016: n=22, mean=3.27; 2019: n=19, mean=3.42; green diamonds: percent positive responses for 2016 and 2019)

5.4 Joint actions – Governing Board members views

Following on from the development of a SRA and IPs, FACCE-JPI's specific actions need to be effective at addressing the aims and objectives of the JPI and relevant for member countries.

5.4.1 Effectiveness of instruments used

FACCE-JPI has launched a large number of actions using a variety of instruments to execute its IPs, with three main types, namely transnational calls (with or without top-up of European Commission funding), alignment instruments (Knowledge Hub, Knowledge Network, Thematic Annual Programming) and exploratory workshops. The Knowledge Network on Sustainable Intensification of Agriculture (KNSI) and the Thematic Annual Programming Network on Improving Agricultural Soil Quality (TAP Soil) have now been included in the survey to GB members since they have been up and running for some time. Recently, FACCE-JPI has also greatly promoted the development of the European Joint Programming Cofund on Soil (EJP SOIL), a European network of research institutes in the field of soil science and agricultural soil management and policies. Although EJP SOIL has not started at the time of the survey to GB members, they were asked to estimate the effectiveness of this instrument as well.

FACCE-JPI's instruments were seen to be **effective in addressing the aims and objectives of FACCE-JPI**, although the degree of agreement varies considerably among them (Figure 8a: percent positive responses and Figure 8b: mean values). Transnational calls were seen as most effective (95% positive response), followed by EJP Cofunds, Knowledge Hubs and Workshops (70% positive responses each). Knowledge Networks and TAP were seen as less effective in addressing the aims of FACCE-JPI (39% and 28% positive responses respectively).

When comparing the three types of instruments in their effectiveness overall (Figure 8c), transnational funding activities (including calls and EJP Cofunds) were seen as most effective (90% positive responses) with an increase of 11% compared to the previous report, followed by alignment activities (50% positive response; comprising Knowledge Hubs, Knowledge Networks and TAP) and

exploring activities (53% positive responses, including workshops). The praise for exploring activities increased by 45% for the instrument at large and even by 93% for workshops when analysing positive responses. (The difference is not as pronounced when analysing mean values of responses (+15% see Figure 8b).)

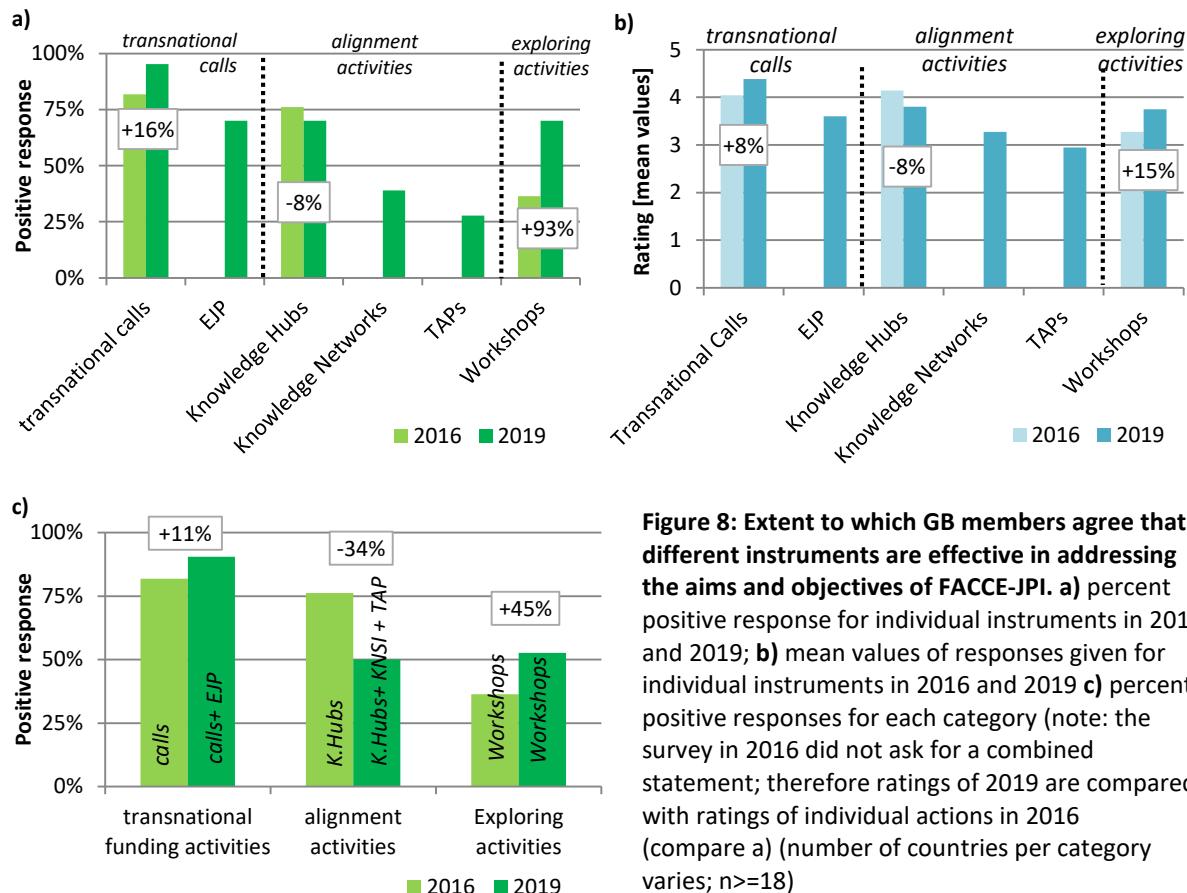


Figure 8: Extent to which GB members agree that different instruments are effective in addressing the aims and objectives of FACCE-JPI. a) percent positive response for individual instruments in 2016 and 2019; b) mean values of responses given for individual instruments in 2016 and 2019 c) percent positive responses for each category (note: the survey in 2016 did not ask for a combined statement; therefore ratings of 2019 are compared with ratings of individual actions in 2016 (compare a) (number of countries per category varies; n>=18)

5.4.1.1 Transnational calls and funding activities

Transnational calls and funding activities were largely seen as key instruments to promote excellent science especially in a transnational context. Still, gaps such as the uptake of results and the facilitation of a coherent approach were mentioned as well as the lack of financial and personnel resources to overcome corresponding obstacles. The European Joint Programme (EJP) Cofund on the other hand has been seen as too complex and too difficult to set up and to understand (6 citations). Although the EJP Cofund might be very effective in addressing important topics such as soil research, it was also pointed out that it may be better suited to subjects where there is a defined national programme, and if this is not the case, inclusiveness may be impaired. Moreover, doubts were raised if the instrument's complexity justifies its outcomes and so GB members are cautiously optimistic with the current EJP SOIL.

5.4.1.2 Alignment activities

With alignment activities decreasing in effectiveness in the view of GB members it is worth taking a closer look at potential reasons. Although **Knowledge Hubs** and especially MACSUR have been considered as the most effective of the three alignment activities to date, criticism was raised regarding the proper exploitation and uptake of results and the lack of direct translation into policy needs. The former survey on alignment in 2016 identified the need to use the Knowledge Hub model for alignment more often. 44% of GB members agreed that this has been taken into account (see Figure 12, page 28). The instrument has been proven to be a valuable tool when it comes to aligning research with limited financial resources. Despite the appreciation of the instrument itself, the use of the Knowledge Hub tool on Food and Nutrition Security (KH FNS) together with JPI Oceans and JPI HDHL was mentioned only twice, maybe due to the lack of funders represented in this network. At the time of surveying the GB members, the follow-up action of MACSUR (Science Policy Knowledge Hub 'Sci-Pol') was still under development and therefore only one GB member highlighted its potential. Lastly, it was mentioned that the Knowledge Hub tool might not be applicable to all research themes. One GB member suggested to explore possibilities for applying the tool for research in the area of pests and diseases.

In contrast to the Knowledge Hub instrument, remarks on KNSI and **Knowledge Networks** in general differ noticeably: criticism highlighted that the instrument's objectives are not commonly understood, that lack of funding impairs proper engagement by the research community, that the instrument's approach is not applicable to all countries, and that outcomes are not visible yet, preventing any exploitation as well as any proper evaluation. Similar comments were raised for TAP Soil and the **TAP instrument** generally, in addition to the question of the role of the TAP Soil with respect to the upcoming EJP SOIL (4 citations).

Despite the fact that a variety of difficulties and obstacles were pointed out, GB members consider alignment and corresponding activities as a core activity of FACCE-JPI and JPIs in general.

Box 1 and Box 2 provide some insight on the alignment actions TAP Soil and KNSI. Members of the Secretariat report on the **current state** of these actions and highlight **difficulties** encountered during the coordination and give some **recommendations** for further improvement.

Box 1: TAP Soil (FACCE-JPI Secretariat, Pablo Gomez, INIA)

FACCE-JPI included the topic “Improving agricultural soil quality” in its IP for 2014-1015. The instrument considered for this purpose was a *Thematic Annual Programming Network* (TAP) and the action defined to implement this topic, focused on SRA Core Theme 2, was the TAP Soil: *Thematic Annual Programming on Organic Matter Sequestration in Soils*. The TAP instrument was proposed as a light alignment tool aimed at fostering the alignment of national research programmes, promoting international cooperation and coordination of national research projects. The expected outputs in this kind of action are open and range from building international networks to providing recommendations, protocols, etc. The TAP Soil network engaged 9 FACCE countries.

The preparatory work started in 2016. A waiting period was necessary due to the different timing of national calls, since TAP Soil actions depend directly on the launch and evolution of national programmes. The TAP Soil Cluster was constituted in 2018 when a minimum significant number of projects were reached. The TAP Soil Cluster kick-off meeting was organised in June 2018 with members of 13 projects participating. This has been the first and the only physical meeting so far. The cluster is currently established and on stand-by.

TAP Soil faced several fundamental difficulties during the implementation process: the challenge to deal with a new and “experimental” tool; the direct dependence on national calls; the low resources and support assigned; the potential overlap with other ongoing and coming initiatives and probably an unrealistic planned timing.

Based on the current experience and the previously mentioned difficulties, the following lessons learned and recommendations can be raised:

- **Further support from the GB** is needed if TAP SOIL shall be maintained.
- Alongside the organisational capacities of the Secretariat there is need for **technical and scientific** support including some corresponding financial compensation.
- TAP Soil needs to be **more adaptive and flexible** to adjust better to national research programmes and their projects.

Box 2: KNSI (FACCE-JPI Secretariat, Dorri te Boekhorst, WR)

The Knowledge Network on Sustainable Intensification (KNSI) was launched in 2016 as an activity of the FACCE-JPI 2014-2015 Implementation Plan. The KNSI aimed to: 1) promote science to investigate opportunities and limitations of sustainable intensification (SI) of agricultural production; 2) including providing information for policy makers, programme managers and other stakeholders; and 3) to inform activity on SI, e.g. function as a ‘think-tank’.

Its objectives were:

- to establish a forum for scientists and R&D-funding organisations (the Committee) to provide knowledge-based advice to funding programs, policy makers and ultimately farmers and the agro-food industry
- to facilitate transnational networking to enhance knowledge exchange between policy makers, research funders, researchers, farmers, land managers and the agri-food industry, along with other stakeholders

In June 2016, a Kick-off meeting was held with the nine countries that had expressed interest in the action. The UK and NL were lead countries on this action.

The KNSI has held four physical and two teleconference meetings between 2016 and 2019. Outputs of the KNSI Committee so far are: a concept note for a common vision for SI; a study on quantifying SI indicators across some participating countries in the network; mapping of the national policy landscape concerning SI for several countries.

During the course of the KNSI, some valuable insights with regard to organising and maintaining a Knowledge Network have been gathered:

- Setting up a Knowledge Network may be feasible if it **delivers on urgent national priorities** and if **(research or policy) questions** are defined in advance.
- The **benefits for those involved (experts and policy makers)** need to be clear.
- The ambitions of the network should be in line with the **amount of work** and with **sufficient funding** for both, the administrative and network participants.

5.4.1.3 Exploring activities: exploratory workshops

Exploratory workshops as the third cluster of FACCE-JPI's instruments were considered largely to be relevant and effective in addressing the initiative's aims. The GB considers that the opportunity to gather ideas, to identify needs and priorities will help FACCE-JPI to stay at the forefront in its remit. However, high and adequate participation is required to ensure suitable outcomes. There is still uncertainty about the objectives of workshops: whether they aim to explore a certain research area, increase knowledge about a specific topic or whether they should aim at concrete and actionable outcomes. It was pointed out that the nature of results should stay adjustable and that the objectives and deliverables should be clear from the beginning. Despite the uncertainty about their aims, the GB largely agreed that the workshops' purposes have been clarified when compared to the last survey in 2016 (50% positive responses; see Figure 12, page 28). Although workshops were seen as relevant to help FACCE-JPI determining its priorities, several suggestions for improvements were made: These range from ensuring the provision of sufficient resources and careful preparation as well as the championing by experts. Proper follow-up of workshops is needed to ensure the workshops' success.

5.4.1.4 FACCE-JPI joint actions – general aspects

When asked whether there are any types of actions or instruments that GB members find to be missing and which should be implemented or used by FACCE-JPI, a variety of answers emerged: starting with the request for more activities and new (unspecified) tools for alignment, to better sharing of national priorities and exchange of various funding instruments across countries, towards a more coherent and streamlined management of FACCE-JPI with clear assignment of roles and responsibilities followed by the suggestion to develop a proper organigram encompassing all relevant tasks and working groups. A FACCE-JPI conference was suggested in order to increase the initiative's visibility and the question was raised if instruments exist or can be developed to synthesise existing research and to make better use of research data and infrastructures. It was pointed out that instruments to link research infrastructures are completely missing (1 citation); however, the development of new infrastructures was seen as least important to FACCE-JPI members (compare Table 2, page 29).

5.4.2 Relevance of actions to member countries

GB members were asked to quantify the extent to which they agreed that FACCE-JPI actions are relevant for their country. The degree of positive answers increased from 55% in 2016 to 81% in 2019, mainly due to a greater proportion agreeing to large extent (Figure 9). Three countries were most positive towards the relevance of FACCE-JPI actions to their countries (agreed to a very large extent). Only one country stated small extent and three countries still stated moderate extent. Where supplementary comments were provided by GB members, those that agreed to a large or very large extent that FACCE-JPI actions were relevant to their country highlighted: the actions they are involved in, the collaboration with other initiatives and JPIs, which allows for the opportunity to coordinate efforts on common topics and to build important partnerships in Europe and beyond, and that the actions address a societal challenge which is relevant to their country. Also, some of the

barriers for participating in actions and/or to follow up on FACCE-JPI activities were identified, such as the lack resources and budget constraints.

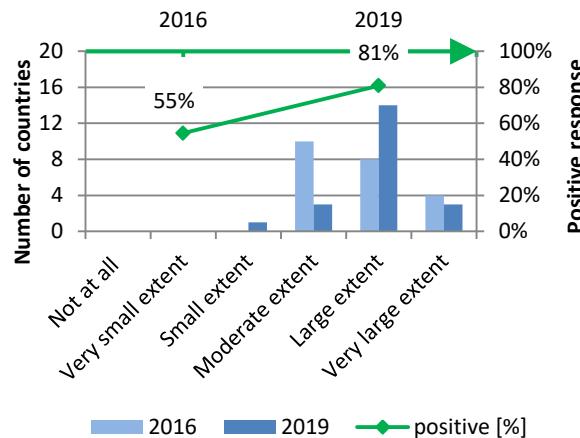


Figure 9: Extent to which GB members agree that different actions are relevant for their country
(bars: number of countries per category; 2016: n=22, mean=3.73; 2019: n=21, mean=3.90; green diamonds: percent positive responses for 2016 and 2019)

5.4.3 Inclusion of international partners in FACCE-JPI actions

Although FACCE-JPI's geographical focus is Europe, there have been a number of actions in collaboration with international partners (i.e. those outside of Europe). As a consequence, FACCE-JPI adopted a strategy for European and International Cooperation⁷ in 2015 and undertook significant efforts to enlarge its global scale by collaborating with international organisations and partners outside Europe. In January 2016, the FACCE-JPI GB membership expanded to include New Zealand as an Associate Member. Further examples include FACCE-JPI's membership in the External Advisory Board of the 4PRIMA Coordination and Support Action, FACCE-JPI's membership in the International Bioeconomy Forum (from October 2016), the membership of the European Commission Joint Research Centre (JRC) in FACCE-JPI's SAB as an Associate Member (from March 2018), as well as collaboration with initiatives (e.g. Joint call "WaterWorks 2015" with Water JPI: 10 non-EU countries, February 2016) and collaboration with partners in ERA-NETs (e.g. in SusCrop: Agriculture and Agri-Food Canada became an Associate Party in October 2017; in the FACCE ERA-GAS joint call with SusAn and ICT Agri ERA-NETs: partners include Canada, Chile, New Zealand and Uruguay, November 2018).

When asked to what extent they **considered beneficial the inclusion of international partners** in FACCE-JPI actions 71% of member countries responded positively, with all but one member country considering inclusion of international partners beneficial to moderate extent or better (95%; Figure 10).

⁷ <https://faccejpi.net/index.php/strateg/international-cooperation>

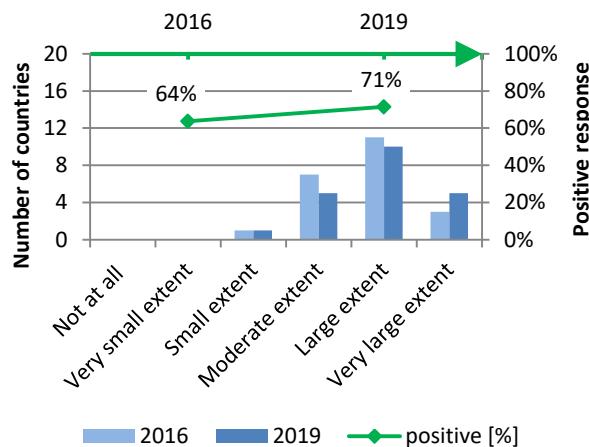


Figure 10: Extent to which FACCE-JPI GB members consider beneficial the inclusion of international partners (outside Europe) in FACCE-JPI actions
(bars: number of countries; 2016: n=22, mean=3.73; 2019: n=21, mean=3.90; green diamonds: percent positive responses for 2016 and 2019)

As previously, GB member cited repeatedly the global nature of the societal challenge that FACCE-JPI addresses and therefore global cooperation was seen as key for success. Seeking synergies with organisations outside Europe and acting within an international environment can also bring added value with regard to FACCE-JPI's knowledge base. A cautious attitude towards the inclusion of international partners was expressed, too, highlighting that collaborations are required to bring added value for FACCE-JPI, its existing member countries and their regions. Examples given of successful collaborations were the ERA-NET on Food and Nutrition Security "FOSC", the joint call of FACCE ERA-GAS with the ERA-NETs SusAn and ICT Agri, and the joint call on Agricultural Greenhouse Gas with the Global Research Alliance. When asked to which extent the inclusion of international partners has been promoted in a targeted and selective way 37% of GB members responded positively (see Figure 12, page 28). This reflects on the one hand the increased positive attitude of FACCE-JPI member countries towards this issue; on the other hand it indicates that more effort is needed to meet the expectations of members.

5.4.4 FACCE-JPI outputs and achievements

GB members were asked to quantify the extent to which they agree that FACCE-JPI is meeting the GB member countries' expectations of outputs in the area of food security, agriculture and climate change. 62% responded positively with the remaining 38% agreeing to a moderate extent (Figure 11). This degree of positivity is an increase of over 70% when compared to the last survey in 2016.

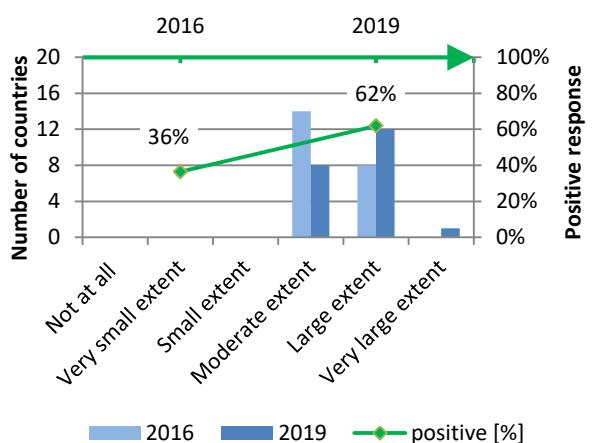


Figure 11: Extent to which FACCE-JPI meets the expectations of GB member countries with regard to outputs in the area of food security, agriculture and climate change
(bars: number of countries; 2016: n=22, mean=3.73; 2019: n=21, mean=3.90; green diamonds: percent positive responses for 2016 and 2019)

GB member comments addressed the importance for FACCE-JPI of providing exploitable solutions in future outputs as well as the need to provide evidence that the European Research Area (ERA) has been reinforced in the intersection between agriculture, food security and climate change by FACCE-JPI. It was noted that specific key performance indicators need to be developed to evaluate FACCE-JPI's impact on the ERA. One member country commented that current financial commitments to the JPI are low, and that this hampers the potential to increase the outputs of the initiative. It was commented that FACCE-JPI put much effort in collaborating with the European Commission with regard to the new framework programme 'Horizon Europe' and that outputs will adapt to this as the initiative will have to reorganise to launch or participate in fewer but larger partnerships.

To identify the **main achievements of FACCE-JPI** to date, the GB members were given the opportunity to provide an open response with their views. 71% of member countries (15 out of 21 total responses) provided a response to this question. As with the previous evaluation report, responses are clustered in categories, which are described further in descending order of number of responses:

- **FACCE-JPI actions (cited 8 times = 53%)**: This includes general references to FACCE-JPI's portfolio of actions or mention of any specific actions as well as the large portfolio of research outcomes. Where specific actions or instruments were named, calls (including ERA-NETs) were most common, followed by MACSUR and the EJP Cofund and eventually alignment actions.
- **Collaborations between FACCE-JPI countries (cited 5 times = 33%)**: This encompasses the benefits seen of bringing the member countries together to jointly address the societal challenge faced by FACCE-JPI, the trust built between FACCE-JPI countries, the co-creation of research programmes and mutual learning between countries.
- **External partnerships and impact on high political level (cited 4 times = 27%)**: These are partnerships that FACCE-JPI has built with actors and initiatives related to FACCE-JPI, and with third (international) countries. This time responses shifted further to the influence of FACCE-JPI on other networks (e.g. on other JPIs) and the European Commission. Examples include FACCE-JPI's impact on the new European Framework programme 'Horizon Europe', on the 5th IPCC (Intergovernmental Panel on Climate Change) report and the Food 2030 strategy as well as providing scientific knowledge for policy and society at large.
- **Organisation and Governance / Strategic Research Agenda (cited 1 time each = 7%)**: The organisational improvement by developing a calendar of upcoming activities and the IP action update as well as the development of the SRA were acknowledged.

In comparison with the previous survey, it can be observed that actions surpassed MACSUR in the number of references for FACCE-JPI actions, and that the upcoming EJP SOIL as well as FACCE-JPI's effort on alignment actions were mentioned as well. This is no surprise as MACSUR ended in July 2017 and new actions including further calls, ERA-NETs, alignment activities and the upcoming EJP SOIL emerged and thereby attracted higher attention amongst GB members. Moreover, GB members also emphasised the impact of FACCE-JPI on other networks, the European Commission and key policies, indicating a general presumption of a greater perception at a high political level and an increased demonstration of FACCE-JPI's expertise in the area of agriculture, food security and climate change.

5.4.5 Review of recommendations from first evaluation cycle / improvements

GB members were asked to which extent the recommendations and suggestions emerging from the first cycle of evaluation have been taken into account. As already mentioned GB meetings were seen as more efficient (60% responded positively, including three to a very large extent) followed by improvement in clarifying workshops' purposes (50% responded positively) and by further implementing the Knowledge Hub model (44% responded positively) (Figure 12). The inclusion of international partners in a targeted and selective way and the advancement of Core Theme 3 were considered as intermediate improvement with 37% and 32% of GB members responding positively respectively. The biggest room for further improvement was seen on the strategic level to advance high-level agreements as well as to reinforce the national ownership (25% and 25% positive responses) and with regard to the need to better communicate outcomes and impacts (20% positive responses). It was, however, also acknowledged that communication and dissemination activities have been reinforced following the adoption of the FACCE-JPI valorisation and communication strategy. Activities under FACCE SURPLUS have also been mentioned as positive examples in this regard.

Suggestions for improvements have been detailed in depth in the corresponding sections above. In addition to the review of recommendations from the first report on alignment, GB members were given the opportunity to give their impression on issues which worsened since 2016 and to state possible solutions to overcome corresponding **barriers**. Seven countries responded to this question. Alongside the obstacle of too high workload emerging from GB meetings (1 citation) and the shortage of personnel and financial resources for both administrative work and for funding research (4 citations), GB members stated the decreased interest of the European Commission in JPIs, as well as their concern about the upcoming European framework programme 'Horizon Europe' (5 citations in total). It was stated that alignment and real engagement are needed as a solid basis for a well-functioning and long-lasting JPI.

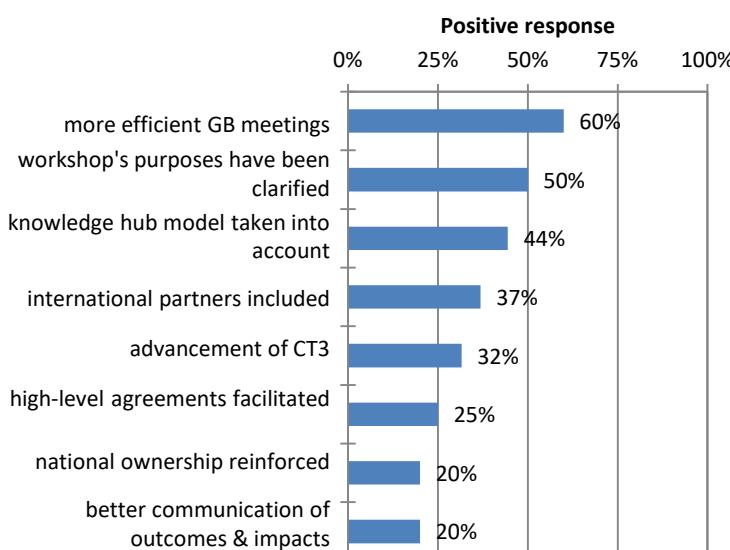


Figure 12: Extent to which GB members consider the recommendations and suggestions emerging from the first cycle of evaluation have been taken into account (percent positive responses for each issue, number of countries per category varies between 18 and 20)

5.5 Future expectations – Governing Board members views

The survey circulated to GB members included a section to gather future expectations of FACCE-JPI. These questions looked to identify the importance of a range of factors both for the country of the respondent and for FACCE-JPI as a whole. These factors included the alignment of national strategies and research programmes (section 5.5.1), researchers, collaborations and research infrastructures (section 5.5.2), and the level of funding for (and impact of) national and transnational activities (section 5.5.3). Table 2 summarises these responses by ranking these issues by importance based on an average score for each issue, both for the respondent country, for FACCE-JPI as a whole and for 2016 and 2019, respectively. The table is organised in descending order of average scores of factors for FACCE-JPI given in 2019. Although a ranking is provided, it should be noted that scores cover quite a narrow range (3.15 to 4.45), suggesting that all factors were considered important by GB member countries, and there is little to differentiate between them. The differences in importance for issues for the national or JPI level between 2016 and 2019 have been calculated and their changes are summarised in the last column of Table 2.

Table 2: Ranking [(a)+(b)] of importance of various factors to GB member countries when considering future expectations of FACCE-JPI. Survey respondents scored each factor [(c), each specific to the area of food security, agriculture and climate change] based on importance to the respondents' own country [(e) and (g)] and for FACCE-JPI as a whole [(d) and (f)]. Numbers in columns (d) to (g) are *mean values*. Percentages in column (h) and (g) show increase or decrease of corresponding mean values between 2016 and 2019. Number in brackets in (a) and (b) indicate ascent or descent of ranking position in comparison to 2016.

Rank in 2019			Rating 2016 (<i>mean values</i>)		Rating 2019 (<i>mean values</i>)		Difference in importance 2016-2019	
JPI level (a)	national level (b)	Factor (c)	JPI level (d)	national level (e)	JPI level (f)	national level (g)	for JPI level (h)	for national level (i)
1 (+1)	1 (+1)	Increasing scientific impact of European research	4,36	4,27	4,33	4,45	-1%	4%
2 (-1)	3 (-1)	Increasing collaborations between current researchers	4,43	4,38	4,19	4,29	-5%	-2%
3 (+4)	8 (+1)	Aligning national research programmes	3,91	3,52	4,15	3,85	6%	9%
4 (-1)	2 (+1)	Increasing European Commission funding for research	4,18	4,14	4,10	4,30	-2%	4%
5 (-1)	4	Increasing collaborations in sharing existing research infrastructure	4,09	4,00	4,10	4,25	0%	6%
6	6 (-1)	Further aligning national strategies	4,05	3,82	4,05	3,90	0%	2%
7 (+1)	7 (+3)	Increasing national funding allocated to transnational activities	3,81	3,50	3,89	3,89	2%	11%
8 (-3)	5 (+1)	Increasing funding allocated to national research	4,05	3,73	3,60	4,10	-11%	10%
9	9 (-1)	Increasing number of researchers	3,50	3,55	3,47	3,74	-1%	5%
10	10 (-3)	Developing / Increasing new research infrastructure	3,41	3,68	3,15	3,42	-8%	-7%

Although differences between the issues are quite low with regard to the level of importance as rated by GB members, a few things can be highlighted:

- First of all, increasing the **scientific impact** of European research and increasing the **collaborations** between current researchers are still most important issues for GB members independent of whether it is for the respondent's country or FACCE-JPI.
- Secondly, further **aligning national research programmes** became more important (increase by 6% for the JPI level) when compared with the rating of 2016. The differences of importance between the national level and JPI level stayed similar (only 3% difference) when comparing 2016 and 2019 values.
- Increasing **European Commission funding** for research, increasing collaborations in sharing existing **infrastructures** and further **aligning national strategies** are equally important when contrasting 2019 values with 2016.
- With regard to funding, a **trend towards increasing funding for national** and transnational research **at national level** is visible. Both issues received a more positive rating for the national level in 2019 than in 2016 (11% and 10% increase respectively) with a comparable decrease in rating for funding allocated to national research for the JPI level.
- Lastly, increasing the number of researchers and developing new or increasing the number of infrastructures was seen as least important for both FACCE-JPI and national level.

The following sections will give greater detail of the member countries' views on different aspects of these factors. Comparable with the previous report in 2017 the evaluation in the text below focuses on the percent positive responses whereas Table 2 displays mean values.

5.5.1 Aligning national strategies and programmes

Both the further alignment of national *strategies* and the alignment of national *programmes* were seen as important for the GB member countries. Both factors received 71% and 70% positive responses⁸ for their *own countries*, which is an 8% decrease and a 34% increase respectively when contrasting to the rating in 2016 (Figure 13, blue bars). With regard to *FACCE-JPI*, both factors were

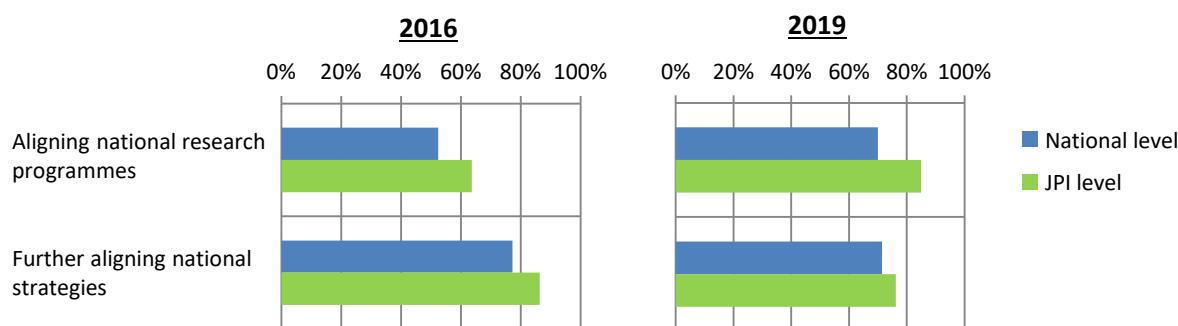


Figure 13: Alignment of research programmes and strategies. Extent to which FACCE-JPI GB member countries assess the importance of further aligning national research programmes and strategies in the area of food security, agriculture and climate change for their own country (blue) or FACCE-JPI (green). (Percent positive responses, for responses given in 2016 or in 2019; number of countries per category varies between 20 and 22)

⁸ A positive response is defined as either agreeing to a large extent or a very large extent (see methodology).

rated important with 76% and 85% of GB members responding positively which is a 11% decrease and a 34% increase compared to 2016. This time **further alignment of national research programmes** became more important, as also displayed in Table 3. Assuming that alignment of national *strategies* is needed before national *programmes* can be aligned, these results suggest that GB members do see a necessity to further align national research strategies but to focus more on the alignment of research programmes particularly within FACCE-JPI.

Furthermore, 52% responded positively that the **FACCE-JPI Strategic Research Agenda would be taken into account in national research programmes** in the next five years which is an increase of 36% compared to 2016 (38% positive response; see Figure 14) . This indicates that GB members generally have a more positive attitude with regard to the uptake of FACCE-JPI's research strategy in national programmes.

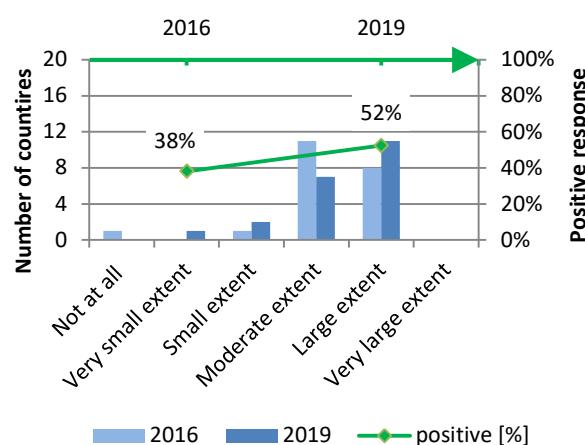


Figure 14: Extent to which it is expected that the FACCE-JPI SRA will be taken into account in national research programmes in the next 5 years (bars: number of countries; 2016: n=21, mean=3.13; 2019: n=21, mean=3.19; green diamonds: percent positive responses for 2016 and 2019)

Member country representatives were asked to identify the **main obstacles for aligning national research programmes**, and to state how they could be overcome. Fewer answers were given to this question when compared with the survey in 2016. The most commonly cited obstacles were: Lack of resources (budget and personnel), the timing between national and transnational calls and programmes, national regulations and procedures including differences in the individual funding cycles and countries' priorities, the variety of different initiatives as well as the large number of instruments and other funding possibilities at the European level, which complicates the selection of appropriate tools. To overcome these barriers only **few suggestions** were made (1 citation each): The recommencement of sharing information on national priorities, funding cycles and the development of flexible alignment instruments that account for the different funding cycles. The new instruments of Horizon Europe were mentioned as a possible solution to simplify the comprehensive range of initiatives and networks and to finally ease decisions at national level.

5.5.2 Researchers, collaborations and research infrastructures

In order to increase high quality transnational research activities within food security, agriculture and climate change, a critical mass of scientists is needed to perform relevant research. Networking of excellent researchers with complementary expertise as well as capacity building (e.g. the training of new researchers, sharing of infrastructures) is equally necessary to result in the desired outcome.

Comparable with the results of the survey in 2016, GB members feel that increasing the number of ***collaborations between existing researchers*** is considerably more important than increasing the *absolute number* of researchers (Figure 15). This applies for national level as well as for the JPI-level. Moreover, the *increase of collaboration* between researchers was seen as the second most important factor (95% responded positively on both levels). *Increasing the number* of researchers was seen as more important on national level (63% positive responses, mean value: 3.74) than on FACCE-JPI level (47% positive responses, mean value: 3.47).

Likewise, GB member countries saw the importance of increasing ***collaboration in sharing existing research infrastructures*** more important than *developing new ones*, for both FACCE-JPI and their own country (Figure 15). In 2016, the increase of sharing existing facilities was seen as slightly more relevant on JPI level (86% positive responses) than on national level (82% positive responses), which inverted in 2019, with a preference for national level (90% positive response versus 80% on JPI-level). In the recent survey, GB members rated the development of new research infrastructures more important with regard to the JPI level (55% positive response) than in 2016 (45% responded positively). Opinions strongly differed between GB members with regard to the importance of increasing collaboration in sharing existing research infrastructure for FACCE-JPI (standard deviation (SD)⁹=1.21) as well as with regard to the importance of developing new research infrastructures for member countries (SD =1.12) and for FACCE-JPI (SD =1.39).



Figure 15: Researchers, collaborations and research infrastructures. Extent to which FACCE-JPI GB member countries assess the importance of increasing collaborations of researchers or their number or of increasing the collaborations in sharing infrastructure or their number in the area of food security, agriculture and climate change for their own country (blue) or FACCE-JPI (green). (Percent positive responses, for responses given in 2016 or in 2019; number of countries per category varies between 19 and 22)

⁹ The smaller the standard deviation (SD), the more agreement exists in the given responses. The average SD for all factors listed in Table 3 is 0.82.

5.5.3 Level of funding for research and its impact

Funding for research in FACCE-JPI's societal challenge can be targeted at the national or transnational levels, and can be funded by member countries and/or the European Commission. The importance of each of these was surveyed amongst GB members, along with the importance of increasing the scientific impact of European research (Figure 16).

It was most important to GB members that there is an increase in **funding** to research within FACCE-JPI's remit from the **European Commission** (90% responded positively for their own country (+10%) as well as for FACCE-JPI as a whole (+4%)). This was followed by the importance of increasing national **funding for transnational** activities (84% (+85%) and 74% (+11%) responded positively for their own country and for FACCE-JPI as a whole and by the importance of increasing national **funding allocation to national** research (85% (+44%) and 55% (-29%) responded positively for their own country and for FACCE-JPI as a whole).

In contrast to 2016, where it was felt that increases were more important for FACCE-JPI as a whole than at the national level, the importance reversed in 2019 with a **tendency to consider more investment at national level** more important.



Figure 16: Level of funding for research and its impact. Extent to which FACCE-JPI GB member countries assess the importance of increasing the impact of research and of increasing funding for research in the area of food security, agriculture and climate change for their own country (blue) or FACCE-JPI (green). (Percent positive responses, for responses given in 2016 or in 2019; number of countries per category varies between 20 and 22)

In addition to assessing the importance of increasing funding from different sources and to different activities, FACCE-JPI GB member countries were asked to provide estimates of **changes to the level of national funding for research** in FACCE-JPI's remit, and to the allocation of funding to FACCE-JPI actions (Figure 17). In contrast to 2016, where the highest proportion of countries foresaw no change in the level of funding for national research or for FACCE-JPI actions in the next five years (50% and 65%, respectively), this trend shifted towards 0.1-5% increase in both cases. The increase in investment is higher on national level than on FACCE-JPI level. Three countries estimated an

increase of over 5% for national research in the FACCE-JPI remit but only one estimated a comparable increase for funding of FACCE-JPI actions. The majority of GB members stated the high priority of the topics as reason for the increase in funding in the research area of FACCE-JPI. Overall growth of research investments was stated, too. One country quoted a substantial increase in funding within its national R&D strategy including specific budget for the initiative's activities. With regard to FACCE-JPI activities, member countries were more cautious on how they might allocate funding, since the research topic and the kind of instrument determine whether a country is able to get involved or not. Finally, it can be said that a clear tendency towards more funding is visible as there was no country indicating a decrease in funding, neither for FACCE-JPI actions nor for national research activities in the area of food security, agriculture and climate change.

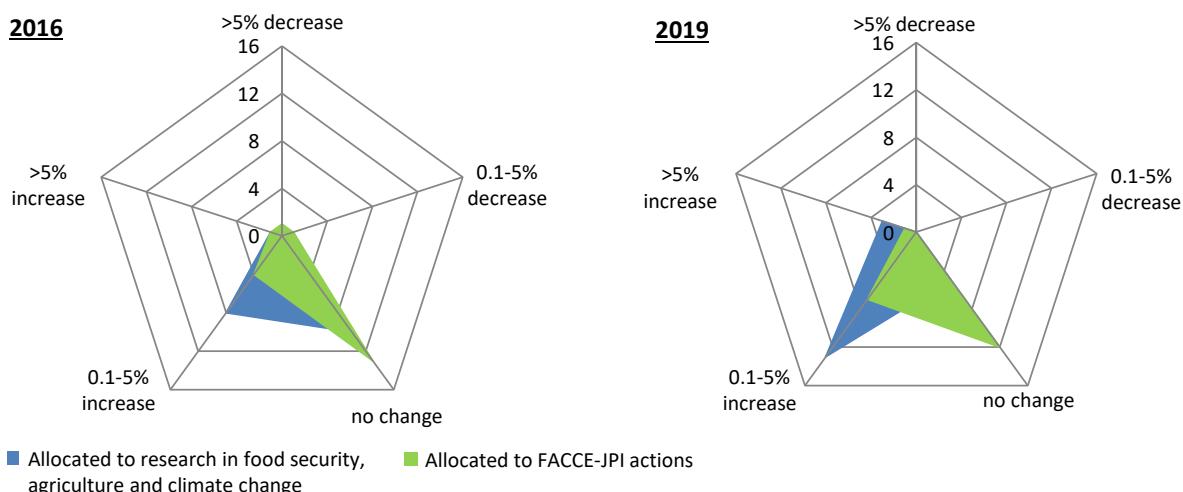


Figure 17: Changes to the level of national funding for research. Estimated changes in next 5 years for national funding allocated for research in the broad area of food security, agriculture and climate change (blue), and for FACCE-JPI actions (green) (percent positive responses, for responses given in 2016 or in 2019; number of countries per category varies between 20 and 21)

As in 2016, GB members overwhelmingly considered that increasing the **scientific impact of European research** in FACCE-JPI's remit was important for both their own countries and for FACCE-JPI as a whole (95% responded positively for their own country (+/-0%) and 90% for FACCE-JPI as a whole (-5%), Figure 16). Of all factors considered by the GB, this was the most important to them, together with increasing collaborations between existing researchers (Table 2, page 29). This complements the opinion expressed by a number of GB members throughout the survey responses that FACCE-JPI needs to be able to demonstrate the impact of the research that it funds and aligns.

6. Results and analysis of Target 2: High quality transnational research activities

According to the monitoring and evaluation framework of FACCE-JPI¹⁰, outcomes of Target 1 (alignment of national and European research programmes) will contribute to the implementation of high quality transnational research activities. The following chapter will demonstrate the contribution of FACCE-JPI member countries to research activities and evaluate to what extent JPI actions and research projects have contributed to high quality transnational research.

This section is based on the evaluation of data held by the Secretariat as well as data from a bibliometric study performed mid-2019. More information on the methodology and the analysis is provided in section 4, in the appropriate figure legend and in the annex (section 8).

6.1 Promoting collaborations and impact on the scientific community

6.1.1 Increase of transnational research activities

Since its beginning, FACCE-JPI launched a number of actions using a variety of instruments. Following the pilot action MACSUR (Phase 1) in 2012, 12 more actions were launched by mid-2019 resulting in 120 research projects and almost 1000 project partners funded by mid-2020 (excluding TAP Soil, KNSI as well as actions being in the selection process at the time of the data collection and assessment) (Figure 18).

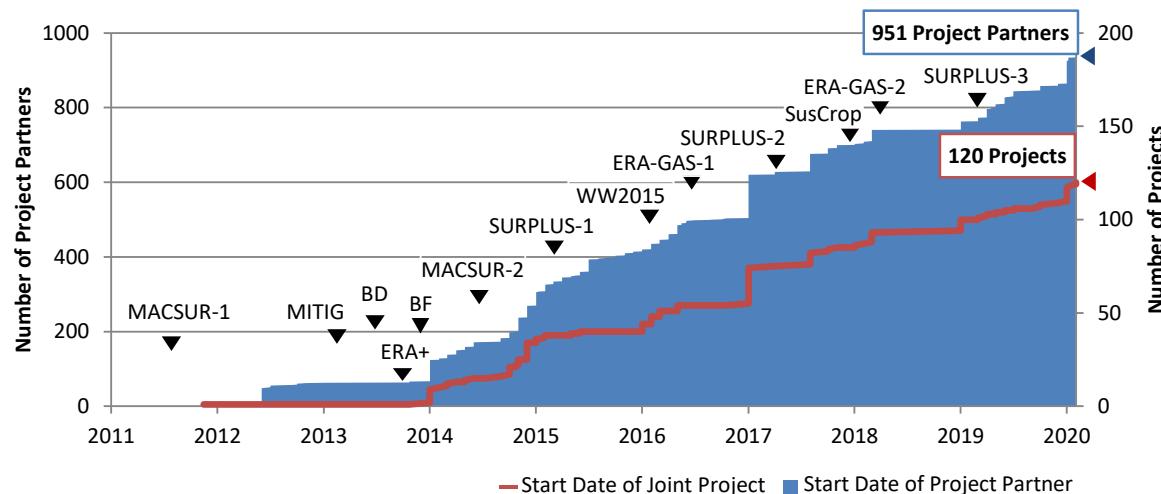


Figure 18: FACCE-JPI increases transnational research activities. Shown are the start dates of research projects (red line, right y-axis) and their corresponding project partners (blue area, left y-axis) over time, taking into account all actions launched between 2011 and mid-2019 excluding TAP Soil and KNSI. The knowledge hub on food and nutrition security (KH FNS), the ERA-NET Cofund on Food Systems and Climate ('FOSC'), the second call of SusCrop (SusCrop-2) as well as the EJP SOIL were not taken into account since their projects have not started at the time of the data collection and assessment. The start dates of the actions are highlighted by black triangles. MITIG=Multipartner call on GHG mitigation, BD=Joint call with BiodivERsA, ERA+=FACCE ERA-NET+, BF=joint call with the Belmont Forum, WW2015=WaterWorks2015, ERA-GAS=FACCE ERA-GAS Cofund, ERA-GAS-2= joint call of FACCE ERA-GAS with the ERA-NETs SusAn and ICT-Agri)

¹⁰ <https://www.faccejpi.net/en/show/FACCE-JPI - Monitoring and Evaluation Framework Final draft v 3.pdf.htm>

6.1.2 Mobilisation of the research community

Mutual learning and knowledge sharing is essential in tackling a global challenge as FACCE-JPI aims to do. The building of new partnerships might therefore support the creation of new knowledge being an ‘intangible asset’ for the European Research Area. In order to assess the scale of new collaborations, project coordinators were asked to state the number of new partners in their consortium. Over 50% of the consulted research projects reported that their project is an almost completely new collaboration with more than 75% of partners being new to the consortium (Figure 19a). Moreover, over 60% of research projects comprise at least 50% new partners. This leads to the assumption that FACCE-JPI fosters the exchange of experiences, knowledge and technologies.

To analyse how many persons were employed and what kind of staff has been recruited for the project, partners of research projects have been consulted. Project partners of 35 projects of four actions¹¹ provided an answer to this question with their end-term reports. Over 400 jobs have been created comprising 40% Postdoctoral researchers and experienced scientists and 35% PhD and Masters Students (Figure 19b). Employment within projects and actions varies, with the FACCE ERA-NET+ call hiring the greatest proportion of research staff per project (225 employees in 11 projects) followed by the joint call with BiodivERsA (103 employees for 10 projects). Numbers were not independently verified concerning potential errors and misinterpretation of the question asked.

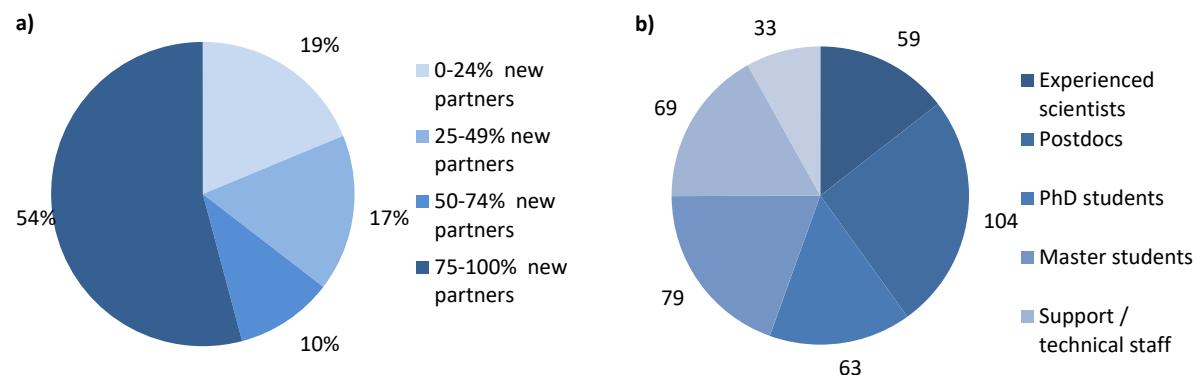


Figure 19: FACCE-JPI mobilises the research community. **a)** Percentage of new partners per project and **b)** number and kind of recruited persons for research projects. Four actions (FACCE ERA-NET+, joint call with BiodivERsA, joint call with the Belmont Forum, first call (co-funded) of FACCE SURPLUS) have been analysed.

Most probably numbers do not equate full time equivalents (FTEs) of corresponding persons. For instance, one project of the FACCE ERA-NET+ call stated to have hired 12 Postdoctoral and experienced scientists. It is not clear if these persons were hired for the entire project period or if they only worked part-time for it.

Taking into account that numbers shown in Figure 19b only represent employed staff for four actions¹⁰ and do not include permanent staff, the number of researchers working within FACCE-JPI projects can be assumed to be much higher. For instance, FACCE-JPI’s first Knowledge Hub action reports over 350 scientists involved in MACSUR 1 and almost 200 scientists involved in MACSUR2. Hence, the FACCE-JPI community can be estimated to be much higher than indicated in Figure 19b.

¹¹ FACCE ERA-NET+, joint call with BiodivERsA, joint call with the Belmont Forum, first call of FACCE SURPLUS

6.1.3 Capacity building, training and professional future

Capacity building and training are seen as an important driver to advance science. FACCE-JPI seeks to promote capacity building and training in joint actions by

- encouraging mobility of researchers in Europe to foster transfer of knowledge,
- stimulating creative thinking and cross-disciplinary exchange of ideas,
- organising workshops or training programmes, open to early career researchers,
- fostering interactions between different stakeholders.¹²

Research consortia were asked to report how many students have been trained during the time of their project. Slightly over 300 PhD and master students were trained within six FACCE-JPI actions¹³ and over 200 researchers took part in mobility actions (Figure 20a). It needs to be pointed out that mobility actions were almost only promoted within MACSUR accounting for 150 of all exchange activities reported. Nevertheless, the total number of trained scientists within FACCE-JPI projects will most certainly be higher, due to the fact that the desired information has not been reported by all projects or actions until now.

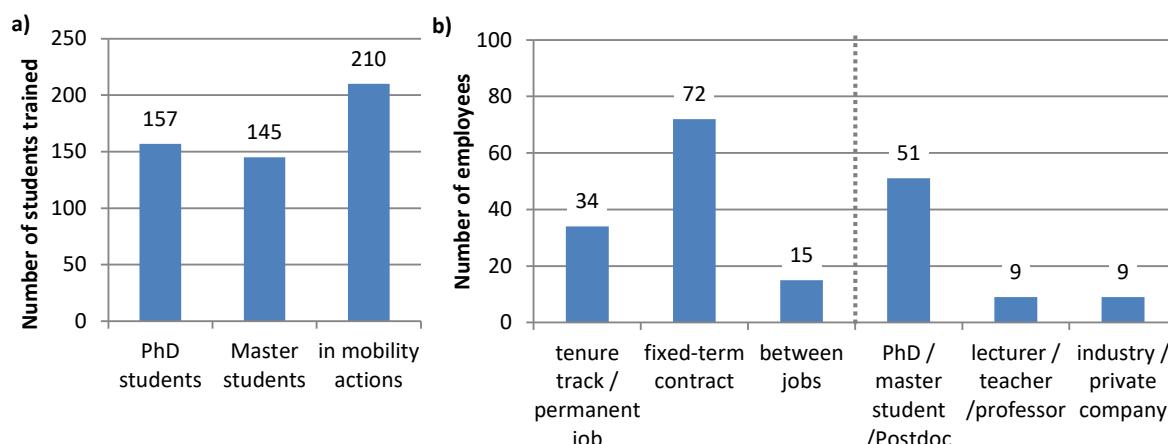


Figure 20: Capacity building, training and professional future within FACCE-JPI. a) Number of students trained as PhD or Master students and in mobility actions and **b)** future of employees with regard to their employment period and position. Six actions (MACSUR phase 1 and 2, Multipartner call on GHG mitigation, FACCE ERA-NET+, joint call with the Belmont Forum, first call of FACCE SURPLUS) have been analysed.

To evaluate if FACCE-JPI is capable of strengthening research and innovation capacities beyond direct support via granted research projects it is worth looking at the employees' future. FACCE ERA-NET+, the joint call with BiodivERsA and SURPLUS-1 serve as examples in this regard. Most of the hired employees were offered fixed-term contracts to continue working on the project or to implement further research at the same institution after the project had finished (Figure 20b). In total, 34 persons were offered and accepted a tenure track or permanent position at the same or another institution following their involvement in a FACCE-JPI project. Many of the employed researchers advance their career by accepting new positions as PhD students or Postdoctoral

¹² Derived from FACCE EVOLVE work package 2: Deliverable 2.5 “Recommendations for training and capacity building in the FACCE domain”

¹³ MACSUR phase 1 and 2, Multipartner call on GHG mitigation, FACCE ERA-NET+, Belmont Forum call, SURPLUS-1

researchers. Other professional future positions mentioned were: lecturer or teacher, positions in industry or private companies. Hence, FACCE-JPI not only supports education and training of scientists in the remit of agriculture, food security and climate change but also facilitates (early) career development of young scientists and professionals in its remit.

6.1.4 Main exploitable outcomes for researchers

To analyse whether researchers of projects funded through joint actions of FACCE-JPI consider any benefit from implementing their project transnationally, researchers of five joint calls¹⁴ were asked to state which of the given exploitable outcomes were of major, moderate or minor importance for their consortium (Figure 21).

Improved scientific evidence base, followed by the development of or access to new methods, data or technologies and increased research capacity were considered the main exploitable outcomes for the consulted consortia. Enhancing their research network to compete for future European project funding and better understanding of stakeholder needs were rated to be of third highest importance for the FACCE-JPI project researchers. New or improved products or services, new technical processes, better access to international networks or markets, better understanding of other European cultures or issues were of minor importance with new organisational process being the most irrelevant outcome. The rating pattern is comparable between the different actions; however, different priorities are clearly evident when assessing actions individually. Researchers funded through BiodivERsA, for instance, rate ‘better understanding of stakeholder needs’ as being as important as ‘improved scientific evidence base’, whereas stakeholder engagement was only of moderate importance for researchers funded through FACCE ERA-NET+. BiodivERsA strongly promotes stakeholder engagement at all stages of the research project; hence, the importance of stakeholder interaction for scientists of this action is not surprising.



Figure 21: Main exploitable outcomes for research consortia. Project coordinators were asked to rate possible outcomes (given) according to their importance for the consortium. The question was based on the pilot action of ERA-LEARN implemented in 2018 (<https://www.era-learn.eu/documents/policybriefimpactprojectlevel.pdf>).

¹⁴ Multipartner call on GHG mitigation, FACCE ERA-NET+, BiodivERsA call, Belmont Forum call, SURPLUS-1

6.2 Implementation of the Strategic Research Agenda

6.2.1 Call topics addressed equally

FACCE-JPI is addressing its strategic priorities through specific actions described in consecutive Implementation Plans. Research calls are one type of action and have been seen as very effective in addressing the aims and objectives of FACCE-JPI (see sections 5.4.1, page 20 and 5.4.1.1, page 21). Nevertheless, it is worth verifying how far a specific call was able to mobilise highly qualified research teams to address the desired research questions and which topics might need some additional attention in the future¹⁵.

The data indicate that not all topics of a given call have been studied equally well by the corresponding research projects (Figure 22). For instance, less projects of the Multipartner call on GHG mitigation devoted their research to topic 1 “Improved methodologies for quantifying GHG emissions and removals in agricultural systems and in national inventories” than to topic 2 “Study of mitigation options at the field, animal and manure management scales with quantification of their technical potential for a range of agricultural systems and regions”. Themes addressed to a lesser extent by FACCE-JPI research projects have been identified and clustered according to different categories and concern

- Research in general:
 - methodologies for quantifying GHG emissions and removals (Multipartner call on GHG mitigation, 18% of projects)
 - pests and diseases linked to climate (FACCE ERA-NET+, 14% of projects)
 - pest and crop management methods and practices (SusCrop1, 15% of projects)
- Policy and societal aspects:
 - policy and governance systems to support agro-ecosystems (joint call with BiodivERsA, 28% of projects)
 - social and economic dimensions of managing and governing water resources (WaterWorks2015, 10% of projects)
- Economic aspects:
 - developing markets through integrated food and non-food systems (SURPLUS-2, 18% of project)
 - production systems to improve food and forest biomass production (FACCE ERA-GAS, 10% of projects)

There are several reasons why a certain topic has not been addressed equally well as others within the same call. The topic might not have attracted as many proposals as other themes or submitted proposals might not be ranked high enough by external evaluation committees to be funded, and finally budget constraints might also affect the number and area of successful research projects. Furthermore, the topic might have been addressed by another initiative.

¹⁵ More information on the analysis can be found in the annex, section 8.1

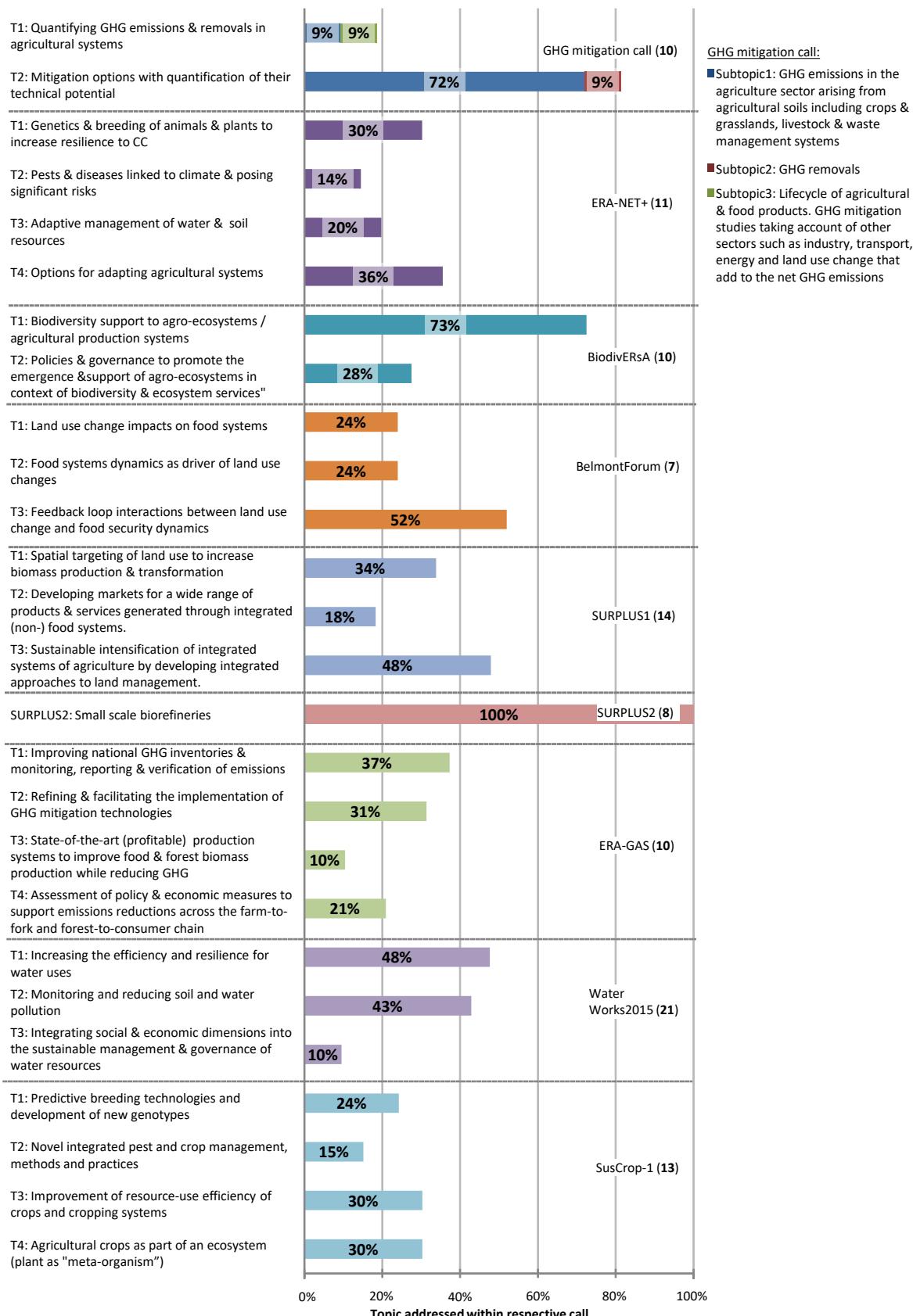


Figure 22: Call topics of FACCE-JPI joint calls and their extent of coverage. More information can be found in the text (section 6.2.1). The analysis of the data is described in the annex (section 8.1). Call topics were shortened to fit the space; T= topic; number in brackets next to call name indicate number of projects

6.3 High quality transnational research

Advancing knowledge and improving understanding of a certain topic is one key element of scientific research. A publication serves as a globally accepted document to widely spread the new information and to allow other researchers to understand and utilise the knowledge¹⁶. Bibliometric analysis provides a powerful tool for information on performance (quantitative), the perception and impact of publications in a defined research area (qualitative), and international scientific collaborations (co-publication analysis). When applying bibliometric indicators it is essential to acknowledge that acquired information provides only a proxy to the object of interest. For instance, citation counts are usually measured as indicators for impact on the scientific community. Citations, however, depend on various factors and might be influenced e.g. by the ‘notoriety’ of the publishing journal (e.g. a journal with a low impact factor), the authors of the document and the institutions involved. Furthermore, there is no all-purpose indicator and as true for all evaluation approaches several indicators need to be applied to obtain a **holistic view** on the quality of research. The bibliometric analysis also greatly depends on the information available and therefore the ‘**visibility**’ of published articles by the FACCE-JPI scientific community is key for the analysis. Further information on the methodology can be found in the corresponding section (methodology, section 4.2). Nevertheless, the results of the bibliometric analysis performed in summer 2019 are expected to give reasonable insights into the quality of FACCE-JPI’s transnational research and will serve as a starting point for later comparison for the quality and quantity of FACCE-JPI’s transnational research activities.

6.3.1 Productivity and recognition rate

The most basic bibliometric analysis is the measure of productivity by counting the number of papers published within a certain period as well as the number of citations that publications have received as indicator for scientific impact and total recognition rate. Between January 2013 and June 2019 FACCE-JPI funded researchers published 591 identifiable articles, review and proceedings papers, which have been cited 6,918 times (C) (Table 3 and Figure 23). This corresponds to an average citation rate (citation per publication, CPP) of 11.7. The percentage of non-cited publications is 20% and thereby below the average of 33% of the database for this period. The percent of self-citation is 13% which is about average.

Table 3: Publications of FACCE-JPI funded researchers for the period 2013 till June 2019. More information can be found in the text or in section 4.2, methodology

Publication 2013 – June 2019		Article, Review, Proceedings Paper	All document types
Number of publication	P	591	600
Number of citations	C	6 918	6 966
Number of citations without self-citations	C _{noself}	6 011	6 054
Self-citation rate [%]	C _{self}	13 %	13 %
Citation per publication / average citation rate	CPP	11.71	11.61
Non-cited publication rate [%]	P _{uncited}	20 %	20 %

¹⁶ Pendlebury, D.A., *Arch. Immunol. Ther. Exp.* (2009) <https://doi.org/10.1007/s00005-009-0008-y>

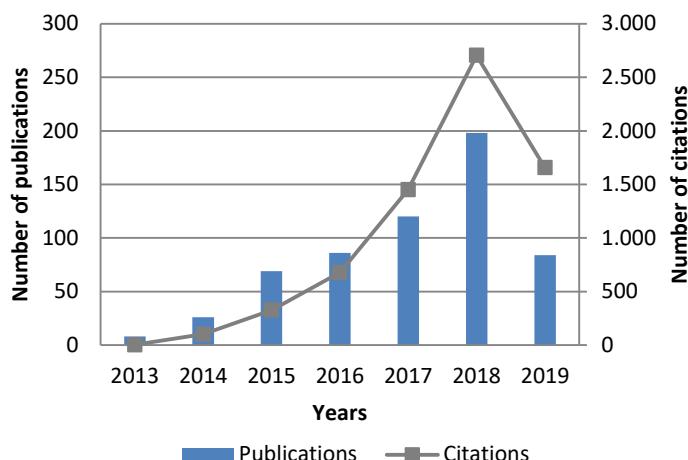


Figure 23: Number of publications by FACCE-JPI researchers and citations for the period 2013 till June 2019. More information on the data query can be found in the methodology, section 4.2. (Incomplete dataset for 2019 due to the time of the analysis (June 2019))

The query used for the bibliometric study searched for documents citing FACCE-JPI, MACSUR and/or WaterWorks2015 (see also methodology, section 4.2). This means only visible publications and articles acknowledging FACCE-JPI can be found and analysed. When attributing publications almost 250 articles can be attributed to MACSUR (Figure 24, yellow sector: 45 articles only citing MACSUR, 204 articles acknowledging FACCE-JPI and MACSUR). Over 300 articles have been published by researchers of other FACCE-JPI joint actions, for instance SURPLUS or the joint calls with the Belmont Forum or with BiodivERsA. 28 articles can be assigned solely to WaterWorks2015.

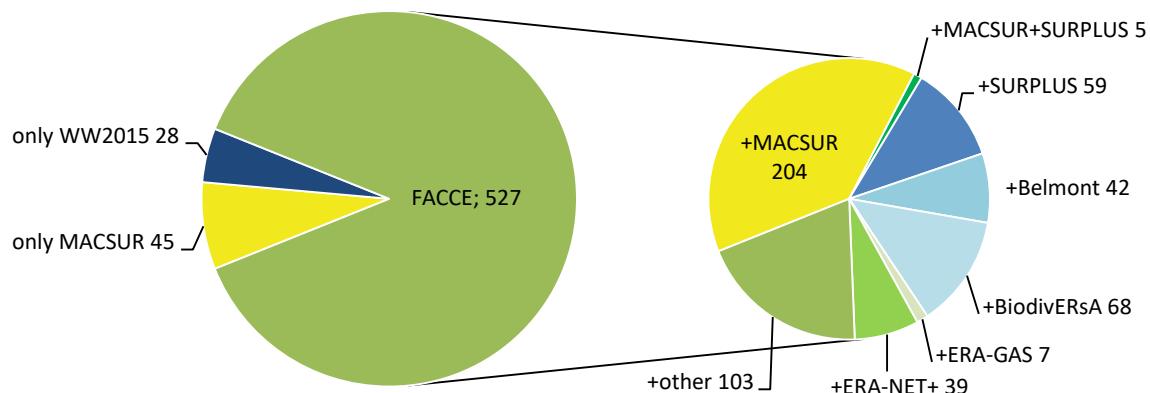


Figure 24: Publication analysed by bibliometric study in June 2019. 600 articles were found with the query (see also methodology, section 4.2), whereas 28 and 45 publications (4.6% and 7.5%) respectively do not acknowledge FACCE-JPI but only WaterWorks2015 or MACSUR. The majority of publications (527 publications, 88%) cite FACCE-JPI and other networks.

6.3.2 Research areas and transdisciplinarity

FACCE-JPI aims to tackle the challenge at the intersection of agriculture, food security and climate change. To evaluate in which areas FACCE-JPI researchers publish, the distribution of publication in research fields was analysed (Figure 25 and Table 4). The biggest percentage of publication can be assigned to the area of ‘Environment and Natural Resources’ (37%). Other frequently used journals belong to the categories ‘Plant Sciences’ (25%), ‘Geosciences’ (15%) and ‘Ecology and Biodiversity’ (14%). Thematic areas of FACCE-JPI publications greatly correlate with the citing literature. For instance a FACCE-JPI paper attributed to the category of ‘Plant Sciences’ is frequently cited by other articles of the same category, namely ‘Plant Sciences’. Hence, FACCE-JPI publications are usually perceived within the same thematic area.

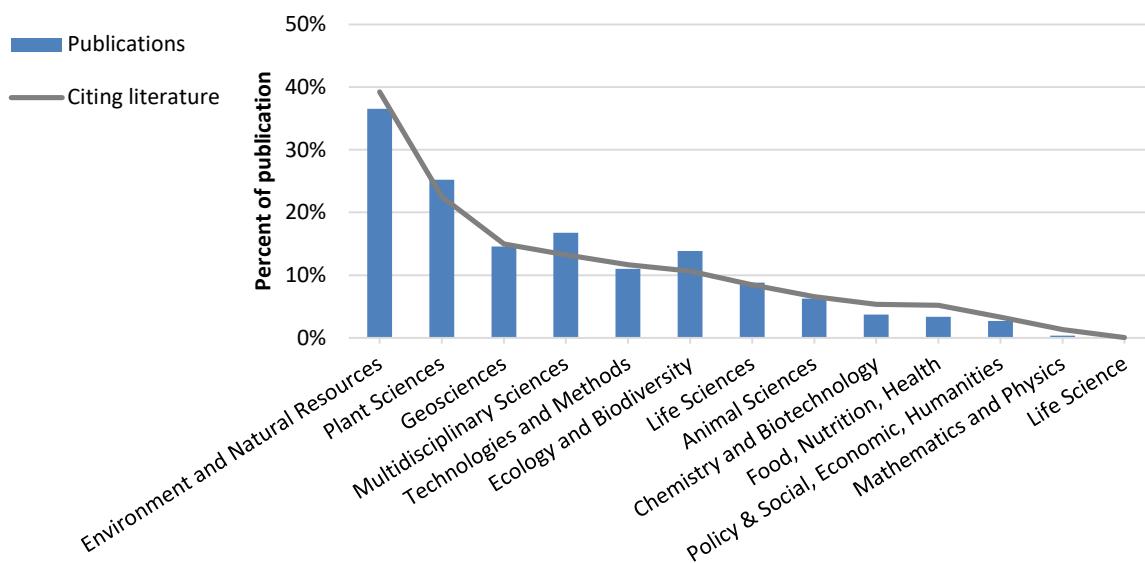


Figure 25: Distribution of publications and citing literature in research areas. Articles, reviews and proceeding papers of FACCE-JPI publications (591 documents) were assigned to different research areas and percent share is shown. Citing literature (5.096 documents) includes all document types with 97% belonging to the aforementioned document types. For reasons of simplicity the 145 Web of Science (WoS) categories have been combined to 12 new, main categories (=research areas) as shown in the figure (x-axis). Publication, which were initially assigned to several WoS categories and which now belong to one main category, have been counted only once per main category. It is still possible that one publication is included in several main categories. More information on the classification can be found in the annex (section 8.2).

The **high correlation between thematic areas of FACCE-JPI publications and citing literature** can also be seen in Table 4. Clear but minor differences occur for Multidisciplinary Sciences and Ecology and Biodiversity, in which the proportion of FACCE-JPI publications (17% and 14% respectively) is higher than the proportion of the citing literature (13% and 11% respectively).

Table 4: Distribution of publications and citing literature in research areas. Articles, reviews and proceeding papers of FACCE-JPI publications (591 documents) were assigned to different research areas. Citing literature (5 096 documents) includes all document types with 97% belonging to the aforementioned document types. For reasons of simplicity the 145 Web of Science (WoS) categories have been combined to 12 new, main categories (=research area). Publication, which were initially assigned to several WoS categories and which now belong to one main category, have been counted only once per main category. It is still possible that one publication is included in several main categories. More information on the classification can be found in the annex (section 8.2).

Research Area	FACCE-JPI publications ($\Sigma=591$)	FACCE-JPI publications [percent share]	Citing literature ($\Sigma=5096$)	Citing literature [percent share]
Environment and Natural Resources	216	37%	2.000	39%
Plant Sciences	149	25%	1.147	23%
Geosciences	86	15%	764	15%
Multidisciplinary Sciences	99	17%	674	13%
Technologies and Methods	65	11%	595	12%
Ecology and Biodiversity	82	14%	542	11%
Life Sciences	52	9%	433	8%
Animal Sciences	37	6%	336	7%
Chemistry and Biotechnology	22	4%	272	5%
Food, Nutrition, Health	20	3%	264	5%
Policy & Social, Economic, Humanities	16	3%	170	3%
Mathematics and Physics	2	0%	68	1%

6.3.3 Keyword Analysis

Keywords of publications can give greater insight into the themes of evaluated literature. Web of Science lists two types of keywords: (i) Author keywords are defined by the authors of the publication according to their assumptions on which words are most important in their work. (ii) KeyWords Plus are index terms automatically generated from the titles of cited articles. KeyWords Plus terms must appear more than once in the bibliography and are ordered from multi-word phrases to single terms¹⁷. Keywords of FACCE-JPI publications have been cleaned by applying a Thesaurus and standardisation. For reasons of clarity a threshold of 10 appearances was chosen. The result is shown in Figure 26.

¹⁷ Web of Science

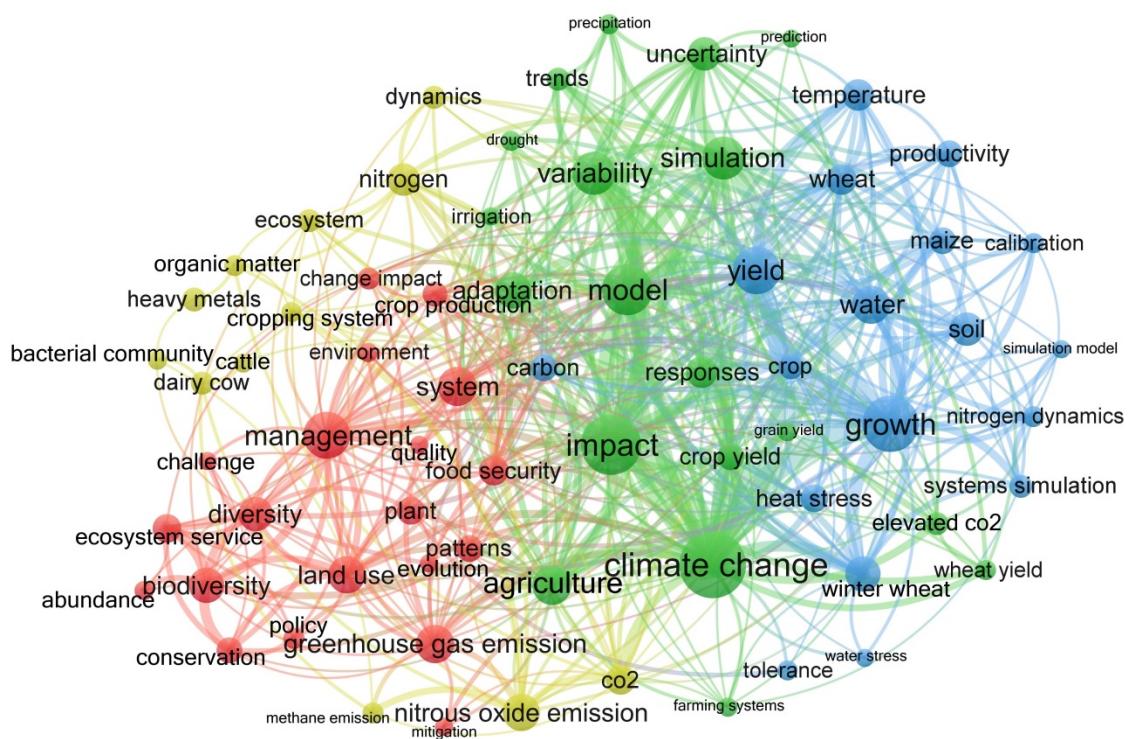


Figure 26: Keyword analysis of FACCE-JPI publications. Keywords were extracted from the ‘Author Keywords’ and ‘Keywords Plus’ fields of Web of Science (WoS) (minimum occurrence of 10). The bigger the circle the more frequent the keyword appearance. Keywords have been clustered according to their joint occurrence and links to other keywords are displayed by lines. The thicker the line the more frequent the keyword is represented jointly in the analysed publication. A thesaurus was applied to minimise semantic ambiguity.

The **keyword analysis** greatly fits FACCE-JPI's research areas and themes. Climate change, impact, model, growth and adaptation are the five main keywords present in FACCE-JPI publications which is not surprising as a great proportion of analysed publications are outputs of MACSUR. The FACCE-JPI terms 'agriculture' and 'food security' are in position 8 and 18 respectively and thereby in the top 1% of all or the top 17% of the shortened (minimum occurrence of 10) list of keywords.

6.3.4 Scientific Excellence: Journal Impact Factor (JIF) and h-index

Several indicators exist to measure the excellence of scientific publications. Probably the best-known indicator is the **journal impact factor (JIF)**. Mean and median JIF of FACCE-JPI publications are 4.4 and 5.8 respectively. 50 articles (9%) have been published in journals with JIFs of 7 or larger and 24 articles (4.2%) have been published in journals with JIFs greater than 10 (Figure 27).

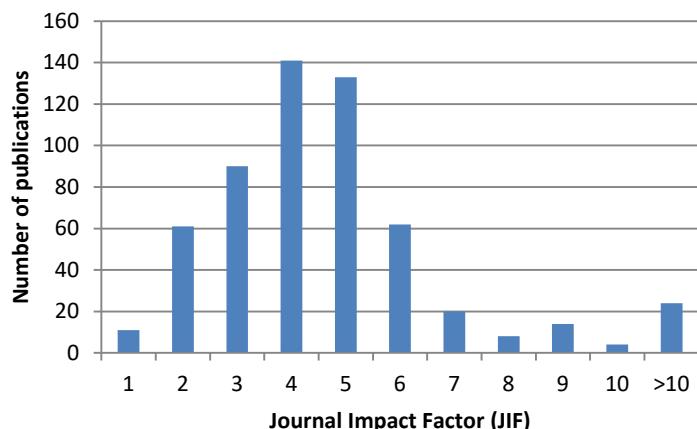


Figure 27: Journal Impact Factor (JIF) of FACCE-JPI publications. Shown are the number of publication and their corresponding JIF at the time of the data analysis (June 2019). Numbers of x-axis represent corresponding JIF and smaller (e.g. JIF='5' means $4 < \text{JIF} \leq 5$)

It is, however, difficult to evaluate the significance of these numbers without any appropriate comparison. Furthermore, the JIF is an indicator for a journal and does not directly account for the quality of the scientific research or its impact. Within a journal, there are typically large differences between publications and their corresponding citations, and therefore it is often considered inappropriate to use the JIF for evaluating research quality. Several organisations even reject the use of the JIF for the evaluation at the level of individual research publications¹⁸.

Another well-known indicator is the **h-index**, a distribution based indicator corresponding to the number of publication which equal or exceed their number of citations. The **h-index of FACCE-JPI publications is 39** which means that 39 papers in the given set were cited at least 39 times each. The h-index thereby reflects both productivity (number of papers) and impact (number of citations) in one number. A distortion caused by highly cited papers or papers that have not yet been cited is thereby corrected. The h-index is thereby relatively insensitive to publications that have received a very large number of citations. Although bearing some advantages, the h-index has been criticised for several reasons: on the one side, the h-index is extremely time-dependent: the longer the evaluation period, the more articles will be published and cited. Hence, the h-index will increase over time. On the other hand, the indicator cannot be normalised to a specific subject area so the performance of FACCE-JPI publications cannot be assessed. Nonetheless, both indicators, JIF and h-index, can be used as benchmarks for assessing the progress of FACCE-JPI research in the future.

6.3.5 Scientific Excellence: Highly cited papers, hot papers

'Highly cited papers' (HCP) and 'hot papers' (HP) are papers, that have received rapid recognition by the scientific community and are therefore considered to be related to scientific excellence and top performance¹⁹. They are mostly published in journals with a high impact factor and are also indicators for 'hot' and emerging scientific areas. **Highly cited papers** must have received enough citations to be ranked in the top 1% when compared with all other papers published in the same year and same research field. At the time of the analysis, 25 publication of FACCE-JPI researchers have been listed as HCP (Table 5), of which eight are assigned to the academic field 'agricultural sciences', eight to 'environment/ecology', four to 'economics & business', two to plant & animal

¹⁸ Cf. The San Francisco Declaration on Research Assessment <https://sfdora.org/>

¹⁹ Clarivate Analytics, Indicator Handbook, 2018: <https://incites.help.clarivate.com/Content/Resources/Docs/InCites-Indicators-Handbook%20-%20June%202018.pdf>

science and one each to computer science and clinical medicine. The four publications assigned to ‘economics & business’ have all been published by researchers funded by MACSUR and collaborating with AgMIP²⁰. Overall, 16 highly cited papers can be attributed to MACSUR, eight to the joint call with the Belmont Forum, and one publication to FACCE ERA-NET+. One paper, related to outcomes of food insecurity in Africa, is assigned to the category of clinical medicine. This paper (Osgood-Zimmerman, A. et al. *Nature* (2018)²¹) is a result of the “DEVIL” project funded through the joint call with the Belmont Forum. A similar indicator for performance and excellence is “hot paper” which must have been cited quickly after publication. They need to be cited enough times within a two-year period after publication to place them in the top 0.1% when compared to other papers in the same field. With regard to the set of analysed FACCE-JPI publications this applies to one paper in the academic field environment/ecology, which was funded through WaterWorks2015. The list of HCPs and HPs can be found in the annex, section 8.4.

Table 5: Highly cited papers and hot papers of FACCE-JPI publications in the period 2013-June 2019. More information on HCPs and HPs can be found in the text. The list of HCPs and HPs is included in the annex, section 8.4.

Web of Science	P	MACSUR	Belmont Forum call	FACCE ERA-NET+	Water Works2015
Highly Cited Papers (HCP)	25				
<i>Agricultural Sciences</i>	9	8	1		
<i>Environment/Ecology</i>	8	2	6		
<i>Economics & Business</i>	4	4			
<i>Plant & Animal Science</i>	2	1		1	
<i>Clinical Medicine</i>	1		1		
<i>Computer Science</i>	1	1			
Hot Papers (HP)	1				
<i>Environment/Ecology</i>	1				1

6.3.6 Performance: Relative impact

FACCE-JPI’s mission to address the diverse challenges in the area of food security, agriculture and climate change results in a wide interdisciplinary scientific scope. To enable a fair comparison of the scientific outputs of FACCE-JPI researchers with those of other scientists a normalisation within the same research area must be carried out. This benchmarking needs to account for the type of field as well as the time of the publication. For instance, mathematics is considered a field with lower number of references and thus less intensive citation than e.g. medicine.^{22,23,24} This will be most likely also true for agricultural research.

The J-factor²⁵ developed by Ball et al. (2009)²⁶ is based “on the idea of evaluating the citations of a target group in relation to a predefined, subject-related reference group. A J-factor of 1 means that

²⁰ Agricultural Model Intercomparison and Improvement Project

²¹ Osgood-Zimmerman, A., Millear, A., Stubbs, R. et al. *Nature* (2018) DOI: 10.1038/nature25760

²² Zitt, M. et al. *Scientometrics* (2005) DOI: 10.1007/s11192-005-0218-y

²³ Adam, D. *Nature* (2002) DOI: 10.1038/415726a

²⁴ Ball, R., et al. *Scientometrics* (2009) DOI: 10.1007/s11192-009-2120-5

²⁵ More information on the J-factor can be found in the annex, section 8.3.

²⁶ Ball, R., Mittermaier, B. and Tunger, D. *Scientometrics* (2009) DOI: 10.1007/s11192-009-2120-5

the articles of a target group are cited with exactly the same frequency as those of the reference group. Accordingly, this target group displays an average citation performance. Correspondingly, J-factors of greater than 1 indicate an above-average citation performance and J-factors of less than 1 a below-average citation performance of the target group in comparison to the relevant reference group.²⁷ The J-factor is based on the expected citation value. The expected citation value is calculated by dividing the number of citations by the number of publication in a given year for a specific journal. It is therefore an indicator for the average citation performance for a defined year. Hence, a given publication and its citation can be compared to the expected citation value and might perform better (J-factor bigger than 1) or worse (J-factor less than 1) than expected. The expected citation value will be higher for journals for which publications have been cited more frequently.

The J-factor for FACCE-JPI publications is 1.4 meaning a **citation performance of 41% above average** in the corresponding field of dissemination. 299 publications have been cited less than average and 292 publications achieved the same or higher citation rate as comparable articles within the same journal (Figure 29). The highest cited paper at the time of data collection is an article in the journal Nature Climate Change²⁸, which is cited 5.7-times more than expected. The majority of FACCE-JPI publications have been published in journals with expected citation values of 10 or less (Figure 28).

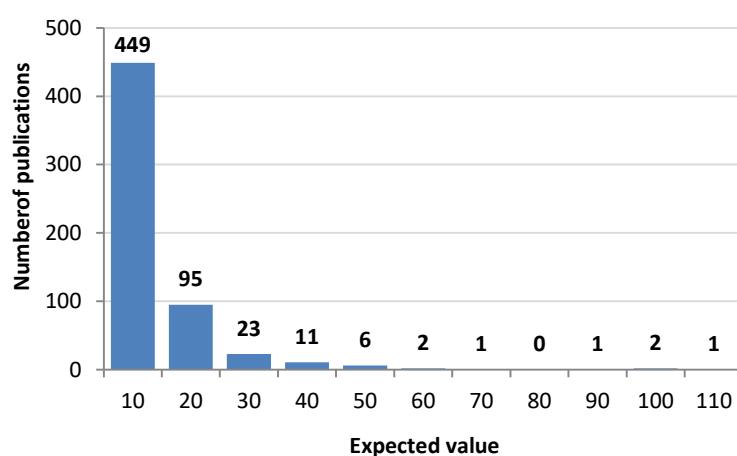


Figure 28: Number of FACCE-JPI publications and their expected citation values. Shown is the distribution of articles, reviews and proceeding papers of FACCE-JPI publications of the analysed period (2013-June2019) amongst the expected citation values. Numbers of x-axis represent range below stated number (e.g. expected value = '10' corresponds to expected values smaller than 10. More information on the expectation value can be found in the text.

²⁷ Adopted from Clermont, M., Dirksen, A., Scheidt, B. et al. *Bus Res*(2017) doi.org/10.1007/s40685-017-0044-0

²⁸ Asseng, S., Ewert, F., Martre, P. et al. Rising temperatures reduce global wheat production. *Nature Clim Change* (2015). <https://doi.org/10.1038/nclimate2470>

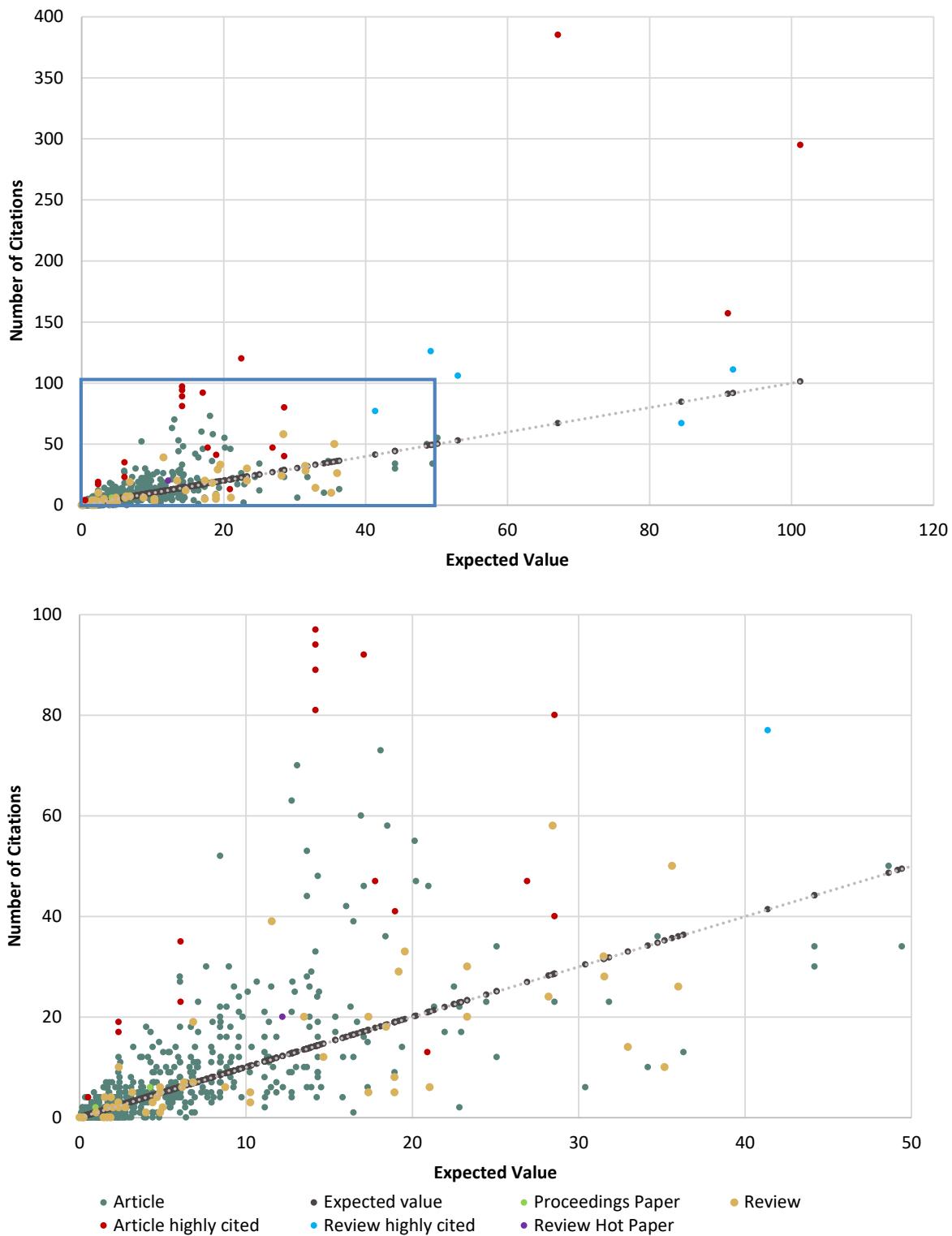


Figure 29: Publications of FACCE-JPI researchers, their number of citations (y-axis) and expected value (x-axis). Scatter chart of articles, reviews, proceeding papers of publications analysed. Top: entire data set bottom: enlarged view, cf. inset of top graphic; J-factor: 1.41. More information on the expected value can be found in the text. The J-factor is described in the text as well as in detail in the annex, section 8.3.

6.3.7 High quality transnational research: Collaboration and global perception

To meet the challenges of agriculture, food security and climate change FACCE-JPI seeks to promote transnational research. Determining the countries involved in FACCE-JPI publications can provide information about the **collaboration activity** within the FACCE-JPI community but also the degree of **transnational outreach activities beyond FACCE-JPI member countries**.

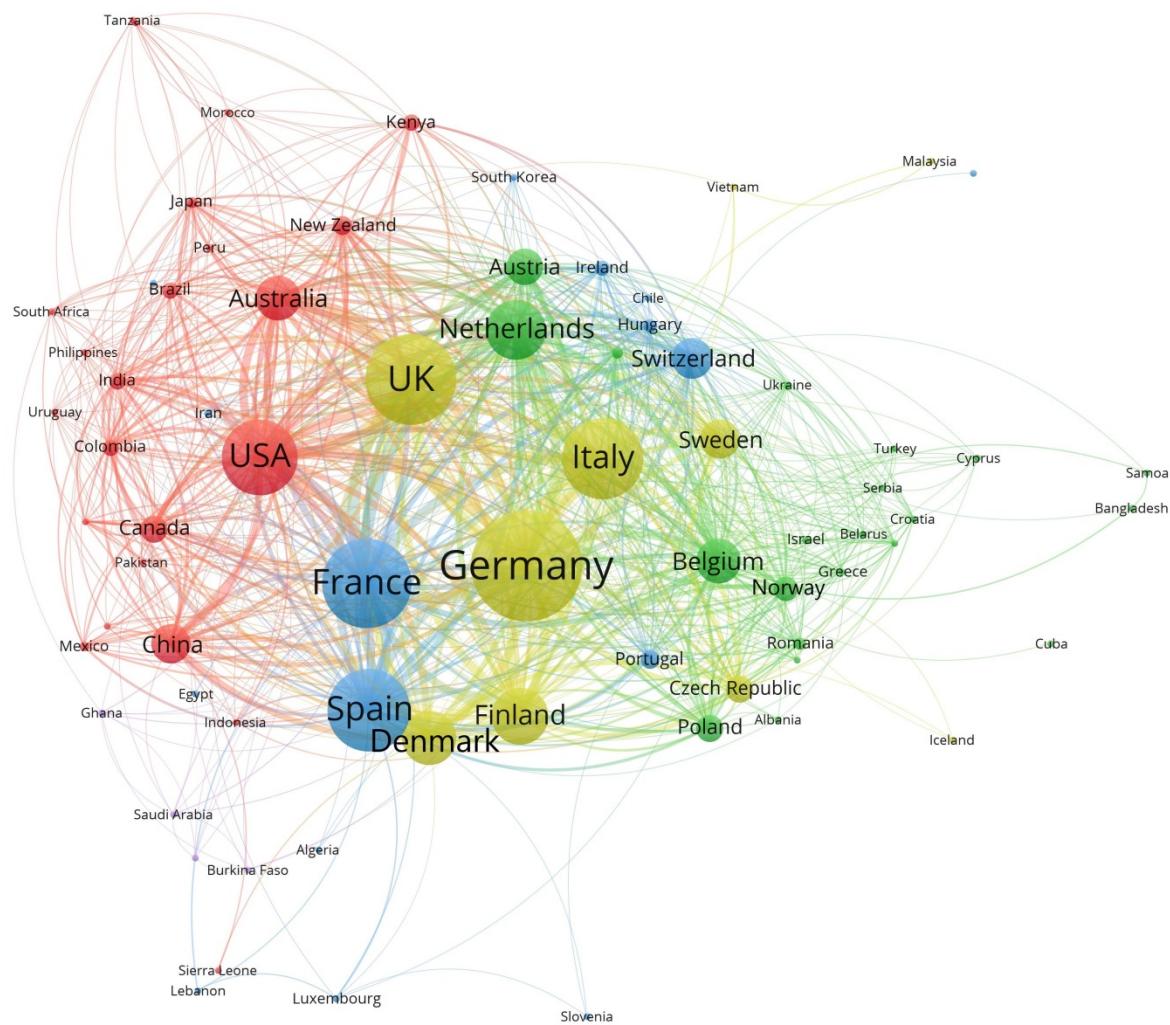


Figure 30: Participating countries of FACCE-JPI publications. The graphic displays countries involved in FACCE-JPI publications as well as their co-authorship. The bigger the circle the greater the number of publications of this country. The thicker a line between two circles the more frequent these countries publish jointly. Same colours refer to a frequent co-publication.

Figure 30 shows countries of the analysed FACCE-JPI publications and their co-publication. Germany, United Kingdom, France, Spain, Italy and USA claim the greatest share of FACCE-JPI publications (all above 100 publications, see also Figure 31a). This greatly correlates with the number of research partners in FACCE-JPI projects: When analysing the 740 project partners of FACCE-JPI projects²⁹ Germany, France, United Kingdom, Spain, Italy and the Netherlands participated with at least 40

²⁹ Excluding actions whose project partners started in 2019 or later and thereby might have most likely not published at the time of the bibliometric analysis

research partners in FACCE-JPI projects (Figure 31b). At the time of the bibliometric analysis Poland, Romania, Denmark, Sweden and Finland have been involved in more than 20 FACCE-JPI projects (Figure 31b), whereas only researchers of Finland and Denmark published more than 50 articles (Figure 31a). In conclusion, the participation of countries in FACCE-JPI publications greatly matches the distribution of project partners within FACCE-JPI projects. Moreover, a **strong collaboration with research partners from the USA** can be detected. Besides the USA, **Australia, China and Canada** have been involved more than 30 times each in the analysed group of publications. New Zealand, as associated member of FACCE-JPI, has been involved in 11 projects and in 19 publications (data not shown).

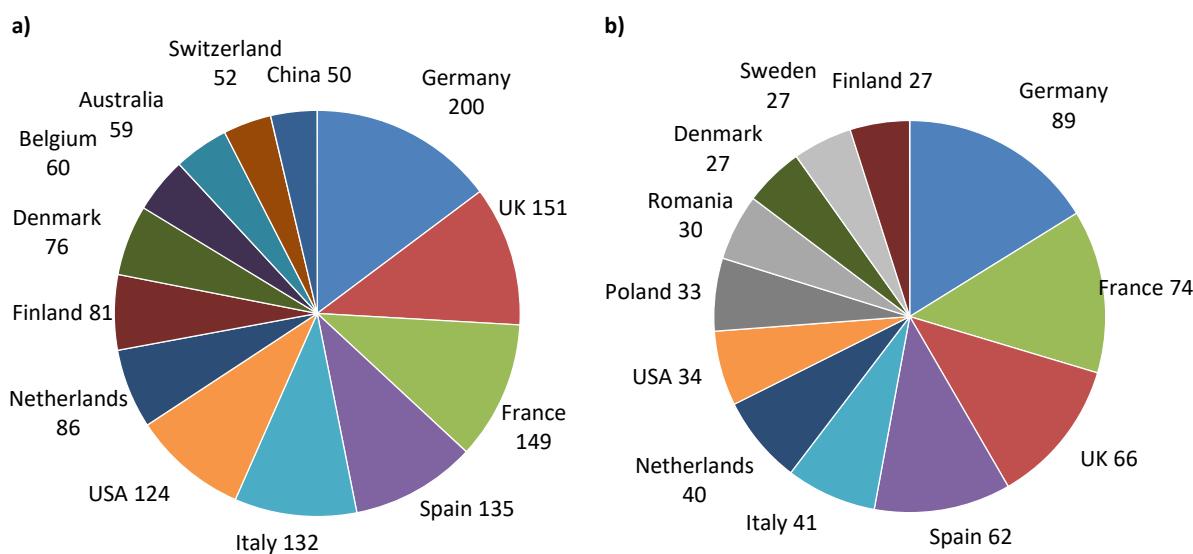


Figure 31 a) Countries participating in FACCE-JPI publications and in b) research consortia. a) Countries represented in publications by FACCE-JPI researchers; minimum occurrence of 50 publications. b) Countries involved in FACCE-JPI research projects (excluding projects starting 2019 or later); minimum involvement in 20 different research projects

The previous section showed to what extent FACCE-JPI was able to empower scientific collaboration within and beyond the initiative's community. As co-authorship indicates direct contact and direct impact of FACCE-JPI on the research community, the evaluation of citations will give more detail on the **global perception and scientific impact** of FACCE-JPI funded research. FACCE-JPI publications are **cited by 155 countries**. Figure 32 shows all countries with a citation rate greater than 100 (22 countries). Again, the five countries involved the most in FACCE-JPI publications (Germany, United Kingdom, France, Spain and Italy) also quote research outputs frequently and belong to the 10 most citing countries. However, **China and USA** are the countries citing FACCE-JPI publication the most (1302 and 1002 citations, respectively) followed by the five FACCE-JPI countries mentioned and **Australia and Canada** (484 and 291 citations, respectively), also being amongst the 10 most citing countries. Other countries beyond Europe citing FACCE-JPI publications more than 100 times include **India, Brazil, Japan** and the FACCE-JPI associated member country **New Zealand** (291, 192, 181, 129 and 108 citations, respectively). In conclusion, research outputs of FACCE-JPI are greatly cited in countries outside the initiative's member countries thus contributing to FACCE-JPI's ambition to tackle challenges in the area of agriculture, food security and climate change in a global manner.

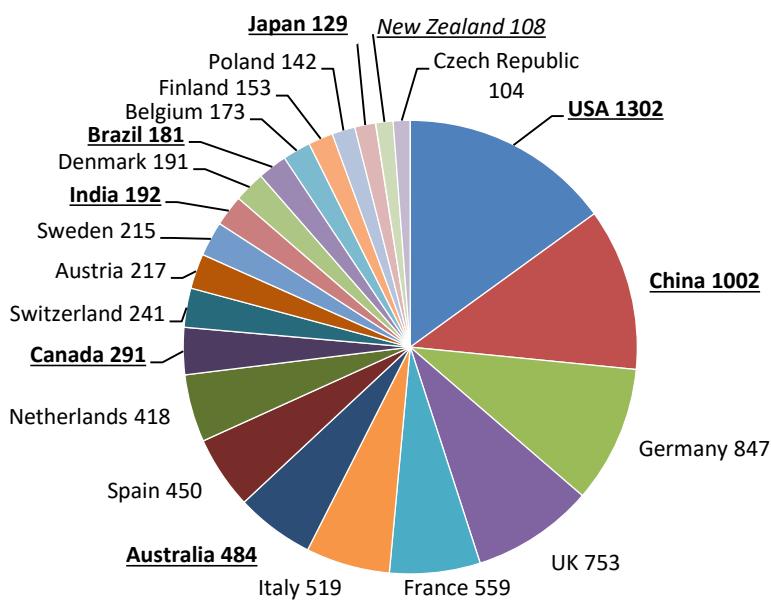


Figure 32: Countries citing FACCE-JPI publications. Shown are countries with more than 100 citations (=22 of 154 countries, 14%) and their number of citations. Non-FACCE-JPI member countries are highlighted in bold and countries outside Europe are underlined.

7. Conclusions

This report is the outcome of the second cycle of evaluation as recommended in the FACCE-JPI framework on Monitoring and Evaluation. It comprises an analysis of the progress towards alignment of national and European research programmes as well as for the first time within FACCE-JPI's lifetime an assessment of FACCE-JPI's outputs with regard to high quality transnational research. The conclusions will be summarised hereunder. Recommendations emerging from the evaluation have been discussed by the Governing Board. Where appropriate, steps for improvement have already been initiated.

7.1 Target 1: Alignment of national and European research programmes

Overall, there is a **positive attitude** of Governing Board (GB) members towards FACCE-JPI and its operational processes and actions. When comparing the outcomes of the first cycle in 2016 with the results of the second survey to GB members implemented in 2019, an **improvement towards the alignment of national and European research programmes is clearly visible**. This includes advancement with regard to the Strategic Research Agenda and its uptake into national research programmes, the praise of the initiative's actions and their relevance to member countries as well as a greater confidence among GB members towards participation in and contribution to joint actions. The recent survey and its comparison with the former clearly show some room for improvement. However, the praise for the initiative and the increased motivation amongst GB members seems to prevail.

7.1.1 Organisation and decision making process

Although the **overall satisfaction** of GB members with the effectiveness of decision making processes decreased compared with results of 2016, the majority of FACCE-JPI's decision makers agreed that the preparation and follow-up of **GB meetings have been improved**, that they receive **enough information** about on-going FACCE-JPI actions and that the **process** to develop the Strategic Research Agenda (SRA) and Implementation Plan (IP) **are effective**.

7.1.2 Strategic alignment

In 2016, only one third of GB members thought that FACCE-JPI's SRA would be taken into account in their national research programmes within the next five years. This expectation increased to more than 50% in 2019, which indicates a **greater impact of FACCE-JPI's research strategy on national research programmes**. Moreover, the number of countries confirming that **FACCE-JPI's SRA has influenced the focus of national research programmes** increased with five countries indicating significant influence. This is also reflected in the greater desire to further align national research *programmes* rather than national *strategies*. Likewise and as before, more than two thirds of GB members agreed that FACCE-JPI's **SRA does reflect their national priorities**. Still, a number of **obstacles** were stated to hinder the adoption of the FACCE-JPI SRA into national research programmes. Amongst others, the dissemination of FACCE-JPI's results has been considered as a key factor to **improve FACCE-JPI's visibility** on a high political level, which in turn could result in improved national commitment.

Regarding the alignment of research strategies the good collaboration with BiodivERsA was highlighted, indicating that there might be no further need for FACCE-JPI to promote this Core Theme. Core Themes 4 and 5 were cited most commonly as effective examples and KNSI and TAP Soil (both Core Theme 2) were pointed out as having great potential. However, alignment actions such as KNSI and TAP Soil were seen as difficult to operate since resources to handle and to sustain these actions are lacking. ERA-NETs and other calls were highlighted as key actions with regard to **avoiding duplication and filling gaps** between FACCE-JPI countries, which overall was seen as **improved by almost two-fold** compared to the last report. In this context, it is worth mentioning that FACCE-JPI adopted its Core Themes in 2020 taking into account future partnerships and missions of the European Commission.

In summary, it can be said that the initiative **made substantial progress towards strategic alignment** as demonstrated by general positive feedback.

7.1.3 Commitment of FACCE-JPI member countries

Commitment was measured through sustained membership of FACCE-JPI, participation of member countries in GB meetings, willingness to host FACCE-JPI meetings and participation in FACCE-JPI actions. Overall, there is a **good level of commitment** by FACCE-JPI member countries, with all countries being involved to some degree.

Participation in joint actions varies, ranging from 38% to 86%, with MACSUR phases 1 and 2, FACCE ERA-NET+ and recently SusCrop and the joint call of FACCE ERA-GAS with the ERA-NETs SusAn and ICT Agri being the actions with the greatest participation rate amongst members. In total, FACCE-JPI member countries invested over 118 Mio € in joint actions for total funding of projects worth over 180 Mio€ resulting in an amplifying effect of almost 160%.

7.1.4 Joint actions

Facing societal challenges concerning all countries, **FACCE-JPI's actions** are seen as **highly relevant** to member countries, with the level of relevance increasing from 55% in 2016 to 81% in 2019. Contrasting the enthusiasm in 2016 toward using the Knowledge Hub model more often, transnational calls have now been cited as most effective in addressing the aims of FACCE-JPI. Alignment actions such as KNSI and TAP Soil were acknowledged for their potential although these instruments are not suitable for all member countries. Still, the **variety of instruments** including alignment actions were seen as essential for FACCE-JPI.

Increasing **collaborations between researchers** was still one of the most important factors when considering future expectations of FACCE-JPI and GB members are **very satisfied with FACCE-JPI's outputs and achievement** as the level of positive responses almost doubled in the last four years. Yet, **increasing the scientific impact** of European research is *the* most important issue to GB members. A first step in monitoring the initiative's outputs with regard to high quality transnational research has been taken with this report.

Workshops were considered to be more effective in addressing FACCE-JPI's objectives compared to the responses given in 2016. This corresponds largely with the majority of GB members agreeing that the purposes of the exploratory actions have been clarified.

The **inclusion of international partners** was considered as largely beneficial for FACCE-JPI with more than two thirds of member countries agreeing to a large extent. With the aim of tackling global society challenges, GB members value the benefit of collaborating with non-European partners. Taking into account that researchers already collaborate with scientists worldwide and that FACCE-JPI publications are seen to a great extent in non-European countries (section 6.3.7), the initiative will envisage partnerships with international partners more intensively in the future.

A clear **tendency towards more funding** in the area of food security, agriculture and climate change is visible at both the national and the JPI level. Alongside the upcoming SRA and IP, FACCE-JPI member countries are currently debating further options to **invest in FACCE-JPI joint actions** in order to meet the challenges of increasing the scientific impact of European research.

7.2 Target 2: High quality transnational research activities

At the end of 2019 FACCE-JPI has launched 11 joint calls, two Knowledge Hubs (KH on FNS and MACSUR, the latter with two completed phases and a third in development) and two alignment actions. By mid-2020 **over 100 research projects** were implemented or started involving almost **1000 project partners**. For the first time FACCE-JPI's scientific performance has been analysed in a comprehensive manner by applying distinct indicators from FACCE-JPI's evaluation framework as well as implementing a bibliometric study. Especially the latter allows field comparison and demonstrated the excellent scientific research facilitated by FACCE-JPI.

In addition, this report assess the **impact on the research community**, which also serves as a benchmark to assess research quality. **Alongside the high-quality transnational research** as demonstrated primarily by the bibliometric analysis, the report also demonstrates the initiative's ability to foster knowledge, to support professional development, to create (to a certain extent) jobs and to advance the scientific evidence base and learning. The following section will summarise the facts of the analysis.

7.2.1 Capacity building & training; Professional future & outcomes for researchers

Over 50% of the project consortia build on almost completely **new collaborations** suggesting that FACCE-JPI functions as a hub for creating new partnerships for knowledge creation. This may also contribute to reducing duplication in its remit. Analysing 35 research projects of four actions³⁰ revealed that **more than 400 jobs have been created**. Likewise more than 300 PhD and Master Students have been **trained** through six actions³¹. FACCE-JPI facilitates **career development** of young scientists and professionals in its remit as shown by evaluating projects of FACCE ERA-NET+, the BiodivERsA joint call and SURPLUS-1. A large proportion of researchers agreed that the **scientific evidence base** has been improved by implementing their research project under FACCE-JPI. The learning of new methods and technologies as well as increasing research capacity was also greatly promoted by the initiative. Activities to support professional development were integrated into the corresponding actions and implemented by granted research projects.

³⁰ FACCE ERA-NET+, joint calls with BiodivERsA and the Belmont Forum, SURPLUS1

³¹ MACSUR phase 1 and 2, Multipartner call on GHG mitigation, FACCE ERA-NET+, joint call with the Belmont Forum, SURPLUS-1

7.2.2 Implementation of the SRA: Call topics

Analysing to which extent granted research projects addressed the given call topics of FACCE-JPI's joint calls revealed that not all **research areas** were addressed equally well (e.g. pests and diseases linked to climate and methodologies for quantifying GHG emissions and removals were barely treated). Likewise, proposed topics concerning policy, societal and economic aspects were covered insufficiently. The latter is also reflected in the insignificant percentage of analysed publications within the 'Policy & Social, Economic, Humanities' category. The reasons for this are surely manifold and need to be analysed in depth.

7.2.3 High quality transnational research

By June 2019 almost **600 articles**, reviews and proceeding papers have been published by FACCE-JPI funded researchers. Although MACSUR accounts for the largest share of these publications, other joint calls are represented well considering that their projects started later than the first of FACCE-JPI's action. It is crucial that researchers funded through projects of joint calls acknowledge FACCE-JPI to allow the bibliometric analysis to be successful. Indeed, the real number of publications might be higher than 600 due to the fact that not all projects refer to FACCE-JPI. **Thematic areas** of publications correspond well with FACCE-JPI research topics; however, it should be noted that the research categories 'Animal Sciences', 'Food, Nutrition, Health' as well as 'Policy & Social, Economic, Humanities' are covered to a lesser extent. Research results have been published in journals with an average **journal impact factor** (JIF) of 4.4 and 24 articles were published in journals with a JIF greater than 10. The **h-index**, a proxy for measuring productivity and citation impact, is 39. Neither of these indicators account for discipline-/ field- based quality and will therefore be more relevant in the future when the progress of these indicators can be assessed and compared with today's values. Within FACCE-JPI, 25 papers were considered as '**Highly Cited Papers**' and one as a "hot paper". Most of these papers are published in the areas 'Agricultural Sciences' (9) and 'Environment/Ecology' (8) but four papers are also assigned to '**Economics & Business**' (4). The latter have all been published by researchers of MACSUR in collaboration with AgMIP. It is worth noting that one paper of researchers funded through the joint call with the Belmont Forum was published in the category of 'clinical medicine' indicating **impact in cross-cutting research areas** and demonstrating FACCE-JPI's transdisciplinary character. These cases reveal the potential of FACCE-JPI when collaborating with global communities and initiatives.

The J-factor enables a fair comparison of outputs of FACCE-JPI researchers with other scientists within the same research area. Evaluation of FACCE-JPI publications reveals a **citation performance 41% above average** indicating **very high quality** of FACCE-JPI within its research field.

The **transnational character** of FACCE-JPI publications is in good accordance with the number and kind of research partners in FACCE-JPI research projects. A high level of collaboration with research partners from the **USA** could be recognised. Besides the USA, other countries outside Europe have been involved more than 30 times in the evaluated publications, namely **Australia, China and Canada**. FACCE-JPI publications are cited by 155 countries indicating **strong global visibility** and **scientific impact** of FACCE-JPI funded research. Besides the non-European countries listed previously, India, Brazil, Japan and New Zealand frequently cite FACCE-JPI's scientific articles.

In summary, it can be said that at this time, MACSUR and the joint action with the Belmont Forum account for the greatest share of excellent publications within FACCE-JPI. Collaboration with global initiatives seems to advance the scientific impact of FACCE-JPI. Given the fact that GB members consider the inclusion of international partners largely beneficial for FACCE-JPI, further efforts will be put in place in the future to set-up new or intensify existing partnerships with non-European partners. Given the number of ongoing and upcoming projects, it is expected that the number of FACCE-JPI publications will increase in the future and the progress of FACCE-JP's transnational research will continue to be monitored.

8. Annex

8.1 Analysing the percentage of topics addressed in a specific research call

Corresponding section: 6.2.1 Call topics addressed equally

Since the approach to analyse to what extent research topics of a specific call have been addressed by selected research projects differs between joint calls, a weighting scheme was applied to present comparable results. This will be explained hereunder for different groups of calls.

Group a) Multipartner call on GHG mitigation and joint call with the Belmont Forum:

Researchers were asked to identify the call topic and subtopic, which has been investigated primarily by the project. Researchers of the mitigation call could select only one combination of topic and subtopic. Researchers of the joint call with the Belmont Forum could select all three topics.

Percentage was calculated accordingly.

Group b) FACCE ERA-NET+, FACCE SURPLUS, FACCE ERA-GAS:

Researchers were asked to state to which extent (substantial, moderate, minor, not at all) their project considered the given call topics. The rating was then converted into a proportional distribution.

Group c) WaterWorks2015, SusCrop, joint call with BiodivERsA:

Research projects were assigned to the given call topics. WaterWorks2015 assigned projects to one of the three subtopics, so percentage per subtopic could be calculated. SusCrop sometimes assigned projects to two topics. This was calculated as a 50% for each topic. BiodivERsA already calculated the percentage of projects to different topics so the overall percentage could be calculated easily.

8.2 Grouping of Web of Science categories

Corresponding section: 6.3.2 Research areas and transdisciplinarity

Every journal and book covered by Web of Science (WoS) core collection is assigned to at least one subject category and every record contains the subject category of its source publication.

Publications of FACCE-JPI researchers can be attributed to 145 WoS categories. These categories have been grouped to 12 new, main categories which are described hereunder. The new categories are headers and the WoS categories are shown in the corresponding table.

Animal Sciences

Agriculture, dairy & animal science	Parasitology
Entomology	Veterinary sciences
Fisheries	Zoology
Ornithology	

Chemistry and Biotechnology

Biotechnology & applied microbiology	Electrochemistry
Chemistry, analytical	Energy & fuels
Chemistry, applied	Materials science, biomaterials
Chemistry, inorganic & nuclear	Materials science, composites
Chemistry, medicinal	Materials science, multidisciplinary
Chemistry, multidisciplinary	Materials science, textiles
Chemistry, organic	Polymer science
Chemistry, physical	Spectroscopy

Ecology and Biodiversity

Biodiversity conservation	Ecology
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Environment and Natural Resources

Environmental sciences	Mining & mineral processing
Environmental studies	Oceanography
Limnology	Soil science
Marine & freshwater biology	Water resources

Food, Nutrition, Health

Allergy	Medicine, research & experimental
Clinical neurology	Neurosciences
Endocrinology & metabolism	Nutrition & dietetics
Food science & technology	Pathology
Gastroenterology & hepatology	Paediatrics
Immunology	Pharmacology & pharmacy
Infectious diseases	Public, environmental & occupational health
Medical informatics	Public, environmental & occupational health
Medical laboratory technology	Tropical medicine
Medicine, general & internal	

Geosciences

Geochemistry & geophysics	Geology
Geography	Geosciences, multidisciplinary
Geography, physical	Meteorology & atmospheric sciences

Life Science

Developmental biology	Microbiology
Biochemistry & molecular biology	Palaeontology
Biology	Physiology
Cell biology	Reproductive biology
Evolutionary biology	Toxicology
Genetics & heredity	Virology

Mathematics and Physics

Astronomy & astrophysics	Optics
Biophysics	Physics, applied
Mathematical & computational biology	Physics, mathematical
Mathematics, applied	Physics, multidisciplinary
Mathematics, interdisciplinary applications	Statistics & probability
Nuclear science & technology	Thermodynamics

Multidisciplinary Sciences

Agriculture, multidisciplinary	Multidisciplinary sciences
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Plant Sciences

Agronomy	Mycology
Forestry	Plant Sciences
Horticulture	

Policy & Social, Economic, Humanities

Agricultural economics & policy	Ethics
Anthropology	History
Archaeology	Humanities, multidisciplinary
Area studies	International relations
Art	Management
Behavioural sciences	Operations research & management science
Business	Political science
Business, finance	Public administration
Demography	Social sciences, interdisciplinary
Development studies	Social sciences, mathematical methods
Economics	Sociology
Education & educational research	Urban studies
Education, scientific disciplines	

Technologies and Methods

Agricultural engineering	Engineering, manufacturing
Automation & control systems	Engineering, mechanical
Biochemical research methods	Engineering, multidisciplinary
Computer science, artificial intelligence	Engineering, ocean
Computer science, hardware & architecture	Green & sustainable science & technology
Computer science, information systems	Imaging science & photographic technology
Computer science, interdisciplinary applications	Information science & library science
Computer science, software engineering	Instruments & instrumentation
Computer science, theory & methods	Mechanics
Construction & building technology	Nanoscience & nanotechnology
Engineering, biomedical	Regional & urban planning
Engineering, chemical	Remote sensing
Engineering, civil	Telecommunications
Engineering, electrical & electronic	Transportation
Engineering, environmental	Transportation science & technology
Engineering, industrial	

8.3 J-factor

Corresponding section: 6.3.6 Performance: relative impact

The J-factor is a journal-based normalised citation metric. It was developed by Ball et al. (2009) and “is based on the idea of evaluating the citations c of a unit or group in relation to a predefined, subject-related reference group. That is to say, for each [...] [target group], the average citations per paper cpp in a certain journal j are related to the average citations per paper in precisely this journal j with the same publication year and the same document type which have been reached by the

reference group R (journal-based normalization). This relation is weighted by the proportion of articles p of the [...] [target group] in this journal with respect to all the articles n of the [...] [target group] during the investigation period. The resulting relations [...] for the respective [...] [target group] are then added up over all journals. [...] A J-factor of 1 means that the articles of a [...] [target group] are cited with exactly the same frequency as those of the reference group. Accordingly, this [...] [target group] displays an average citation performance. Correspondingly, J-factors of greater than 1 indicate an above-average citation performance and J-factors of less than 1 a below-average citation performance of the [...] [target group] in comparison to the relevant reference group.”³²

8.4 List of highly cited and hot papers

Corresponding section: 6.3.5 Scientific Excellence: Highly cited papers, hot papers

List of highly cited papers (HCPs):

1. Asseng, S.; Ewert, F.; Martre, P.; Roetter, R. P.; Lobell, D. B.; Cammarano, D.; Kimball, B. A.; Ottman, M. J.; Wall, G. W.; White, J. W.; Reynolds, M. P.; Alderman, P. D.; Prasad, P. V. V.; Aggarwal, P. K.; Anothai, J.; Basso, B.; Biernath, C.; Challinor, A. J.; De Sanctis, G.; Doltra, J.; Fereres, E.; Garcia-Vile, M.; Gayler, S.; Hoogenboom, G.; Hunt, L. A.; Izaurrealde, R. C.; Jabloun, M.; Jones, C. D.; Kersebaum, K. C.; Koehler, A-K.; Mueller, C.; Kumar, S. Naresh; Nendel, C.; O'Leary, G.; Olesen, J. E.; Palosuo, T.; Priesack, E.; Rezaei, E. Eyshi; Ruane, A. C.; Semenov, M. A.; Shcherbak, I.; Stoeckle, C.; Strattonovitch, P.; Streck, T.; Supit, I.; Tao, F.; Thorburn, P. J.; Waha, K.; Wang, E.; Wallach, D.; Wolf, I.; Zhao, Z.; Zhu, Y. (2015):
Rising temperatures reduce global wheat production
NATURE CLIMATE CHANGE, Vol. 5, Is. 2, p. 143 – 147
DOI: 10.1038/NCLIMATE2470
Times cited: 385
(The expected citation value of 67.10 is exceeded by a factor of 5.7.)
HCP in the Academic Field of Environment/Ecology
2. Paustian, Keith; Lehmann, Johannes; Ogle, Stephen; Reay, David; Robertson, G. Philip; Smith, Pete (2016):
Climate-smart soils
NATURE, Vol. 532, Is. 7597, p. 49 – 57
DOI: 10.1038/nature17174
Times cited: 295
(The expected citation value of 101.24 is exceeded by a factor of 2.9.)
HCP in the Academic Field of Environment/Ecology
3. Trnka, Miroslav; Roetter, Reimund P.; Ruiz-Ramos, Margarita; Kersebaum, Kurt Christian; Olesen, Jorgen E.; Zalud, Zdenek; Semenov, Mikhail A. (2014):
Adverse weather conditions for European wheat production will become more frequent with climate change
NATURE CLIMATE CHANGE, Vol. 4, Is. 7, p. 637 – 643
DOI: 10.1038/NCLIMATE2242
Times cited: 157
(The expected citation value of 91.06 is exceeded by a factor of 1.7.)
HCP in the Academic Field of Environment/Ecology
4. Smith, Pete; House, Joanna I.; Bustamante, Mercedes; Sobocka, Jaroslava; Harper, Richard; Pan, Genxing; West, Paul C.; Clark, Joanna M.; Adhya, Tapan; Rumpel, Cornelia; Paustian, Keith; Kuikman, Peter; Cotrufo, M. Francesca; Elliott, Jane A.; McDowell, Richard; Griffiths, Robert I.; Asakawa, Susumu; Bondeau, Alberte; Jain, Atul K.; Meersmans, Jeroen; Pugh, Thomas A. M. (2016):

³² Adopted from Clermont, M., Dirksen, A., Scheidt, B. et al. Bus Res (2017) 10: 249.
<https://doi.org/10.1007/s40685-017-0044-0>

- Global change pressures on soils from land use and management**
GLOBAL CHANGE BIOLOGY, Vol. 22, Is. 3, p. 1008 – 1028
DOI: 10.1111/gcb.13068
Times cited: 126
(*The expected citation value of 49.19 is exceeded by a factor of 2.6.*)
HCP in the Academic Field of Environment/Ecology
5. Smith, Pete (2016):
Soil carbon sequestration and biochar as negative emission technologies
GLOBAL CHANGE BIOLOGY, Vol. 22, Is. 3, p. 1315 – 1324
DOI: 10.1111/gcb.13178
Times cited: 120
(*The expected citation value of 22.51 is exceeded by a factor of 5.3.*)
HCP in the Academic Field of Environment/Ecology
6. Herrero, Mario; Henderson, Benjamin; Havlik, Petr; Thornton, Philip K.; Conant, Richard T.; Smith, Pete; Wirsén, Stefan; Hristov, Alexander N.; Gerber, Pierre; Gill, Margaret; Butterbach-Bahl, Klaus; Valin, Hugo; Garnett, Tara; Stehfest, Elke (2016):
Greenhouse gas mitigation potentials in the livestock sector
NATURE CLIMATE CHANGE, Vol. 6, Is. 5, p. 452 – 461
DOI: 10.1038/NCLIMATE2925
Times cited: 111
(*The expected citation value of 91.78 is exceeded by a factor of 1.2.*)
HCP in the Academic Field of Environment/Ecology
7. Lipiec, J.; Doussan, C.; Nosalewicz, A.; Kondracka, K. (2013):
Effect of drought and heat stresses on plant growth and yield: a review
INTERNATIONAL AGROPHYSICS, Vol. 27, Is. 4, p. 463 – 477
DOI: 10.2478/intag-2013-0017
Times cited: 106
(*The expected citation value of 53.00 is exceeded by a factor of 2.*)
HCP in the Academic Field of Agricultural Sciences
8. Valin, Hugo; Sands, Ronald D.; van der Mensbrugghe, Dominique; Nelson, Gerald C.; Ahammad, Helal; Blanc, Elodie; Bodirsky, Benjamin; Fujimori, Shinichiro; Hasegawa, Tomoko; Havlik, Petr; Heyhoe, Edwina; Kyle, Page; Mason-D'Croz, Daniel; Paltsev, Sergey; Rolinski, Susanne; Tabeau, Andrzej; van Meijl, Hans; von Lampe, Martin; Willenbockel, Dirk (2014):
The future of food demand: understanding differences in global economic models
AGRICULTURAL ECONOMICS, Vol. 45, Is. 1, p. 51 – 67
DOI: 10.1111/agec.12089
Times cited: 97
(*The expected citation value of 14.19 is exceeded by a factor of 6.8.*)
HCP in the Academic Field of Economics & Business
9. von Lampe, Martin; Willenbockel, Dirk; Ahammad, Helal; Blanc, Elodie; Cai, Yongxia; Calvin, Katherine; Fujimori, Shinichiro; Hasegawa, Tomoko; Havlik, Petr; Heyhoe, Edwina; Kyle, Page; Lotze-Campen, Hermann; d'Croz, Daniel Mason; Nelson, Gerald C.; Sands, Ronald D.; Schmitz, Christoph; Tabeau, Andrzej; Valin, Hugo; van der Mensbrugghe, Dominique; van Meijl, Hans (2014):
Why do global long-term scenarios for agriculture differ? An overview of the AgMIP Global Economic Model Intercomparison
AGRICULTURAL ECONOMICS, Vol. 45, Is. 1, p. 3 – 20
DOI: 10.1111/agec.12086
Times cited: 94
(*The expected citation value of 14.19 is exceeded by a factor of 6.6.*)
HCP in the Academic Field of Economics & Business
10. Ewert, F.; Rotter, R. P.; Bind, M.; Webber, H.; Trnka, M.; Kersebaum, K. C.; Olesen, J. E.; van Ittersum, M. K.; Janssen, S.; Rivington, M.; Semenov, M. A.; Wallach, D.; Porter, J. R.; Stewart, D.; Verhagen, J.; Gaiser, T.; Palosuo, T.; Tao, F.; Nendel, C.; Roggero, P. P.; Bartosova, L.; Asseng, S. (2015):
Crop modelling for integrated assessment of risk to food production from climate change
ENVIRONMENTAL MODELLING & SOFTWARE, Vol. 72, p. 287 – 303
DOI: 10.1016/j.envsoft.2014.12.003

- Times cited: 92*
(The expected citation value of 17.09 is exceeded by a factor of 5.4.)
HCP in the Academic Field of Computer Science
11. Nelson, Gerald C.; van der Mensbrugghe, Dominique; Ahammad, Helal; Blanc, Elodie; Calvin, Katherine; Hasegawa, Tomoko; Havlik, Petr; Heyhoe, Edwina; Kyle, Page; Lotze-Campen, Hermann; von Lampe, Martin; Mason d'Croz, Daniel; van Meijl, Hans; Mueller, Christoph; Reilly, John; Robertson, Richard; Sands, Ronald D.; Schmitz, Christoph; Tabeau, Andrzej; Takahashi, Kiyoshi; Valin, Hugo; Willenbockel, Dirk (2014):
Agriculture and climate change in global scenarios: why don't the models agree
AGRICULTURAL ECONOMICS, Vol. 45, Is. 1, p. 85 - 101
DOI: 10.1111/agec.12091
- Times cited: 89*
(The expected citation value of 14.19 is exceeded by a factor of 6.3.)
HCP in the Academic Field of Economics & Business
12. Mueller, Christoph; Robertson, Richard D. (2014):
Projecting future crop productivity for global economic modeling
AGRICULTURAL ECONOMICS, Vol. 45, Is. 1, p. 37 - 50
DOI: 10.1111/agec.12088
- Times cited: 81*
(The expected citation value of 14.19 is exceeded by a factor of 5.7.)
HCP in the Academic Field of Economics & Business
13. Koechy, M.; Hiederer, R.; Freibauer, A. (2015):
Global distribution of soil organic carbon - Part 1: Masses and frequency distributions of SOC stocks for the tropics, permafrost regions, wetlands, and the world
SOIL, Vol. 1, Is. 1, p. 351 - 365
DOI: 10.5194/soil-1-351-2015
- Times cited: 80*
(The expected citation value of 28.55 is exceeded by a factor of 2.8.)
HCP in the Academic Field of Agricultural Sciences
14. Semenov, M. A.; Strattonovitch, P.; Alghabari, F.; Gooding, M. J. (2014):
Adapting wheat in Europe for climate change
JOURNAL OF CEREAL SCIENCE, Vol. 59, Is. 3, p. 245 - 256
DOI: 10.1016/j.jcs.2014.01.006
- Times cited: 77*
(The expected citation value of 41.38 is exceeded by a factor of 1.9.)
HCP in the Academic Field of Agricultural Sciences
15. Rezaei, Ehsan Eyshi; Webber, Heidi; Gaiser, Thomas; Naab, Jesse; Ewert, Frank (2015):
Heat stress in cereals: Mechanisms and modelling
EUROPEAN JOURNAL OF AGRONOMY, Vol. 64, Is. 0, p. 98 - 113
DOI: 10.1016/j.eja.2014.10.003
- Times cited: 67*
(The expected citation value of 84.5 is achieved by 80%.)
HCP in the Academic Field of Agricultural Sciences
16. Muller, Adrian; Schader, Christian; Scialabba, Nadia El-Hage; Bruggemann, Judith; Isensee, Anne; Erb, Karl-Heinz; Smith, Pete; Klocke, Peter; Leiber, Florian; Stolze, Matthias; Niggli, Urs (2017):
Strategies for feeding the world more sustainably with organic agriculture
NATURE COMMUNICATIONS, Vol. 8
DOI: 10.1038/s41467-017-01410-w
- Times cited: 47*
(The expected citation value of 17.78 is exceeded by a factor of 2.6.)
HCP in the Academic Field of Environment/Ecology
17. Carlson, Kimberly M.; Gerber, James S.; Mueller, Nathaniel D.; Herrero, Mario; MacDonald, Graham K.; Brauman, Kate A.; Havlik, Petr; O'Connell, Christine S.; Johnson, Justin A.; Saatchi, Sassan; West, Paul C. (2017):
Greenhouse gas emissions intensity of global croplands
NATURE CLIMATE CHANGE, Vol. 7, Is. 1, p. 63

- DOI: 10.1038/NCLIMATE3158
Times cited: 47
(The expected citation value of 29.91 is exceeded by a factor of 1.7.)
HCP in the Academic Field of Environment/Ecology
18. Wang, Enli; Martre, Pierre; Zhao, Zhigan; Ewert, Frank; Maiorano, Andrea; Roetter, Reimund P.; Kimball, Bruce A.; Ottman, Michael J.; Wall, Gerard W.; White, Jeffrey W.; Reynolds, Matthew P.; Alderman, Phillip D.; Aggarwal, Pramod K.; Anothai, Jakarat; Basso, Bruno; Biernath, Christian; Cammarano, Davide; Challinor, Andrew J.; De Sanctis, Giacomo; Doltra, Jordi; Fereres, Elias; Garcia-Vila, Margarita; Gayler, Sebastian; Hoogenboom, Gerrit; Hunt, Leslie A.; Izaurralde, Roberto C.; Jabloun, Mohamed; Jones, Curtis D.; Kersebaum, Kurt C.; Koehler, Ann-Kristin; Liu, Leilei; Mueller, Christoph; Kumar, Soora Naresh; Nendel, Claas; O'Leary, Garry; Olesen, Jorgen E.; Palosuo, Taru; Priesack, Eckart; Rezaei, Ehsan Eyshi; Ripoche, Dominique; Ruane, Alex C.; Semenov, Mikhail A.; Shcherbak, Iurii; Stockle, Claudio; Stratonovitch, Pierre; Streck, Thilo; Supit, Iwan; Tao, Fulu; Thorburn, Peter; Waha, Katharina; Wallach, Daniel; Wang, Zhimin; Wolf, Joost; Zhu, Yan; Asseng, Senthil (2017):
The uncertainty of crop yield projections is reduced by improved temperature response functions
NATURE PLANTS, Vol. 3, Is. 8
DOI: 10.1038/nplants.2017.102
Times cited: 41
(The expected citation value of 18.98 is exceeded by a factor of 2.2.)
HCP in the Academic Field of Plant & Animal Science
19. Smith, P.; Cotrufo, M. E.; Rumpel, C.; Paustian, K.; Kuikman, P. J.; Elliott, J. A.; McDowell, R.; Griffiths, R.; Asakawa, S.; Bustamante, M.; House, J., I.; Sobocka, J.; Harper, R.; Pan, G.; West, P. C.; Gerber, J. S.; Clark, J. M.; Adhya, T.; Scholes, R. J.; Scholes, M. C. (2015):
Biogeochemical cycles and biodiversity as key drivers of ecosystem services provided by soils
SOIL, Vol. 1, Is. 2, p. 665 - 685
DOI: 10.5194/soil-1-665-2015
Times cited: 40
(The expected citation value of 28.55 is exceeded by a factor of 1.4.)
HCP in the Academic Field of Agricultural Sciences
20. Maiorano, Andrea; Martre, Pierre; Asseng, Senthil; Ewert, Frank; Mueller, Christoph; Rotter, Reimund P.; Ruane, Alex C.; Semenov, Mikhail A.; Wallach, Daniel; Wang, Enli; Alderman, Phillip D.; Kassie, Belay T.; Biernath, Christian; Basso, Bruno; Cammarano, Davide; Challinor, Andrew J.; Doltra, Jordi; Dumont, Benjamin; Rezaei, Ehsan Eyshi; Gayler, Sebastian; Kersebaum, Kurt Christian; Kimball, Bruce A.; Koehler, Ann-Kristin; Liu, Bing; O'Leary, Garry J.; Olesen, Jorgen E.; Ottman, Michael J.; Priesack, Eckart; Reynolds, Matthew; Stratonovitch, Pierre; Streck, Thilo; Thorburn, Peter J.; Waha, Katharina; Wall, Gerard W.; White, Jeffrey W.; Zhao, Zhigan; Zhu, Yan (2017):
Crop model improvement reduces the uncertainty of the response to temperature of multi-model ensembles
FIELD CROPS RESEARCH, Vol. 202, p. 5 - 20
DOI: 10.1016/j.fcr.2016.05.001
Times cited: 35
(The expected citation value of 6.07 is exceeded by a factor of 5.8.)
HCP in the Academic Field of Agricultural Sciences
21. Webber, Heidi; Martre, Pierre; Asseng, Senthil; Kimball, Bruce; White, Jeffrey; Ottman, Michael; Wall, Gerard W.; De Sanctis, Giacomo; Doltra, Jordi; Grant, Robert; Kassie, Belay; Maiorano, Andrea; Olesen, Jorgen E.; Ripoche, Dominique; Rezaei, Ehsan Eyshi; Semenov, Mikhail A.; Stratonovitch, Pierre; Ewert, Frank (2017):
Canopy temperature for simulation of heat stress in irrigated wheat in a semi-arid environment: A multi-model comparison
FIELD CROPS RESEARCH, Vol. 202, p. 21 - 35
DOI: 10.1016/j.fcr.2015.10.009
Times cited: 23
(The expected citation value of 6.07 is exceeded by a factor of 3.8.)
HCP in the Academic Field of Agricultural Sciences

22. Challinor, Andrew J.; Mueller, Christoph; Asseng, Senthil; Deva, Chetan; Nicklin, Kathryn Jane; Wallach, Daniel; Vanuytrecht, Eline; Whitfield, Stephen; Ramirez-Villegas, Julian; Koehler, Ann -Kristin (2018):
Improving the use of crop models for risk assessment and climate change adaptation
AGRICULTURAL SYSTEMS, Vol. 159, p. 296 - 306
DOI: 10.1016/j.agrsy.2017.07.010
Times cited: 19
(The expected citation value of 2.35 is exceeded by a factor of 8.1.)
HCP in the Academic Field of Agricultural Sciences
23. Ruiz-Ramos, M.; Ferrise, R.; Rodriguez, A.; Lorite, I. J.; Bindt, M.; Carter, T. R.; Fronzek, S.; Palosuo, T.; Pirttioja, N.; Baranowski, P.; Buis, S.; Cammarano, D.; Chen, Y.; Dumont, B.; Ewert, F.; Gaiser, T.; Hlavinka, P.; Hoffmann, H.; Hoehn, J. G.; Jurecka, F.; Kersebaum, K. C.; Krzyszczak, J.; Lana, M.; Mechiche-Alami, A.; Minet, J.; Montesino, M.; Nendel, C.; Porter, J. R.; Ruget, F.; Semenov, M. A.; Steinmetz, Z.; Stratonovitch, P.; Supit, I.; Tao, F.; Trnka, M.; de Wit, A.; Roetter, R. P. (2018):
Adaptation response surfaces for managing wheat under perturbed climate and CO₂ in a Mediterranean environment
AGRICULTURAL SYSTEMS, Vol. 159, p. 260 - 274
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