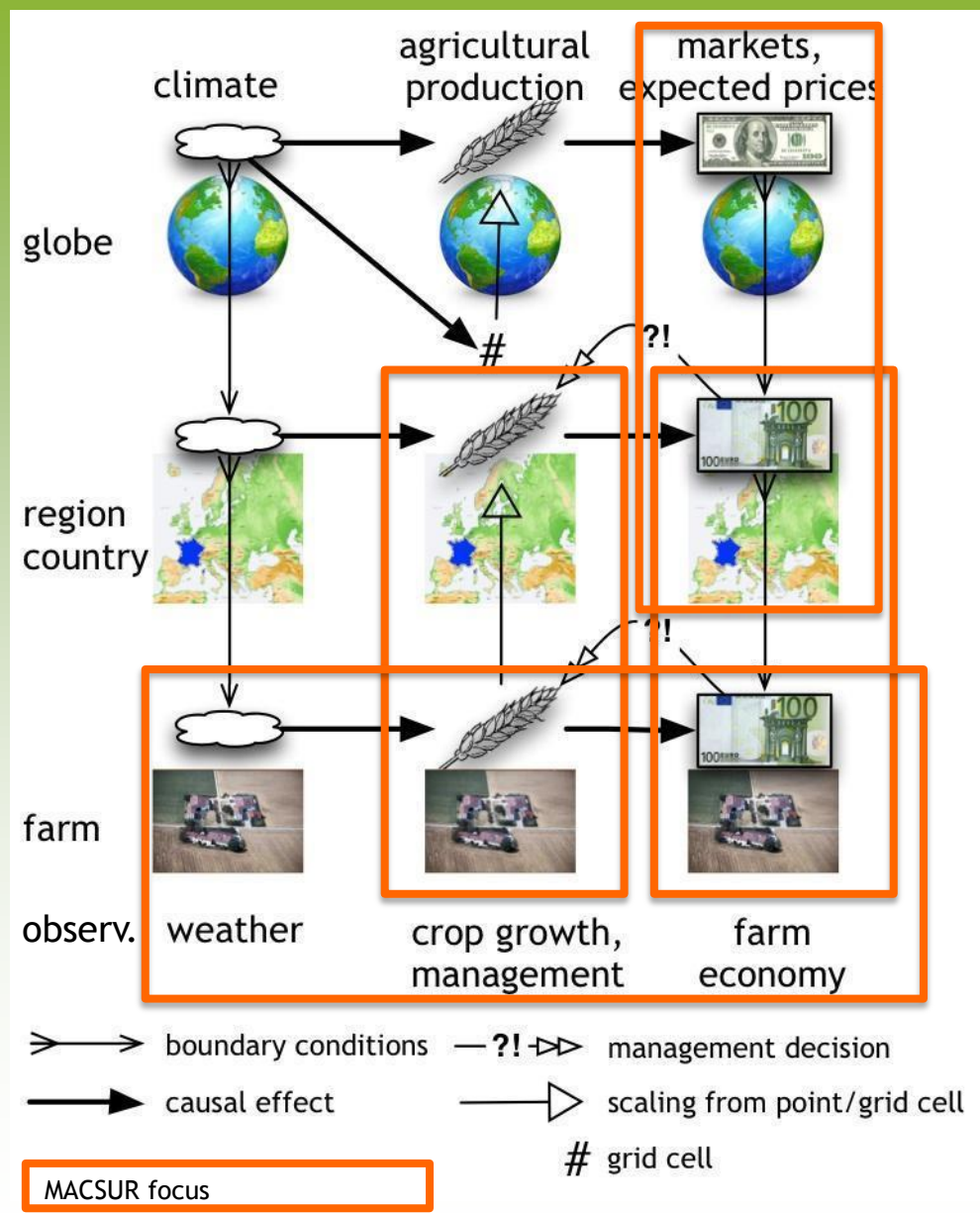# FACCE-JPI Knowledge Hub

**M**odelling European **A**griculture with **C**limate Change for Food **S**ecurity

André Bannink (Wageningen UR)

Martin Köchy (Thünen Institute)

climate — agricultural production — markets, expected prices

globe

region country

farm

observ. | weather | crop growth, management | farm economy

⮞⟶ boundary conditions   —?!⮞⮞ management decision
⟶ causal effect   —▷ scaling from point/grid cell
grid cell

MACSUR focus

MACSUR's mission: **Improving the modelling cascade** for interdisciplinary and multi-scale integration

affordable food
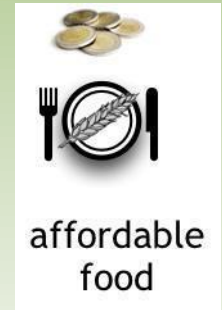
MACSUR's aims

- ## improve and integrate models
  - crop and livestock production, farms, and national & international agri-food markets

- ## improve integration & links
  - of models for selected farming systems and regions

- ## provide hands-on training
  - to junior and experienced researchers in integrative modeling

- ## identify risks and consequences of adaptation and mitigation in agriculture
  for better availability, accessibility & affordability of food

linked models

Key activities in MACSUR

- Good-practice approaches/guidelines
- Model comparison & improvement
  - model description, output comparison, new approaches
- Uncertainty and risk assessments
  - data, assumptions, scaling, model linking, new approaches
- Regional case studies: impacts, adaptation
  - description, output comparison, new approaches
- Capacity building: courses, staff exchange
- Impact assessments for Europe & regions
  - Adaptation and mitigation options, sustainability aspects
- Networking: meetings, new projects, AgMIP et al.
- Involvement of stakeholders (EU, national, regional)

- MACSUR (3 yr) 2012–2015
  17 countries, 0–1M €/cntry
  180 members

- MACSUR2 (2 yr) 2015–2017
  18 countries,
  300 members

- output after 4 years
  - 310 papers/chapters
  - 200 reports
  - 500 presentations
  - 31 workshops/conferences
  - 13 funded new projects
  - 24 PhD/MSc students

© EuroGeographics for the administrative boundaries

Quality and impact take time

peer-reviewed publications acknowledging MACSUR

start of MACSUR

∑=100

May

2012 2014 2016
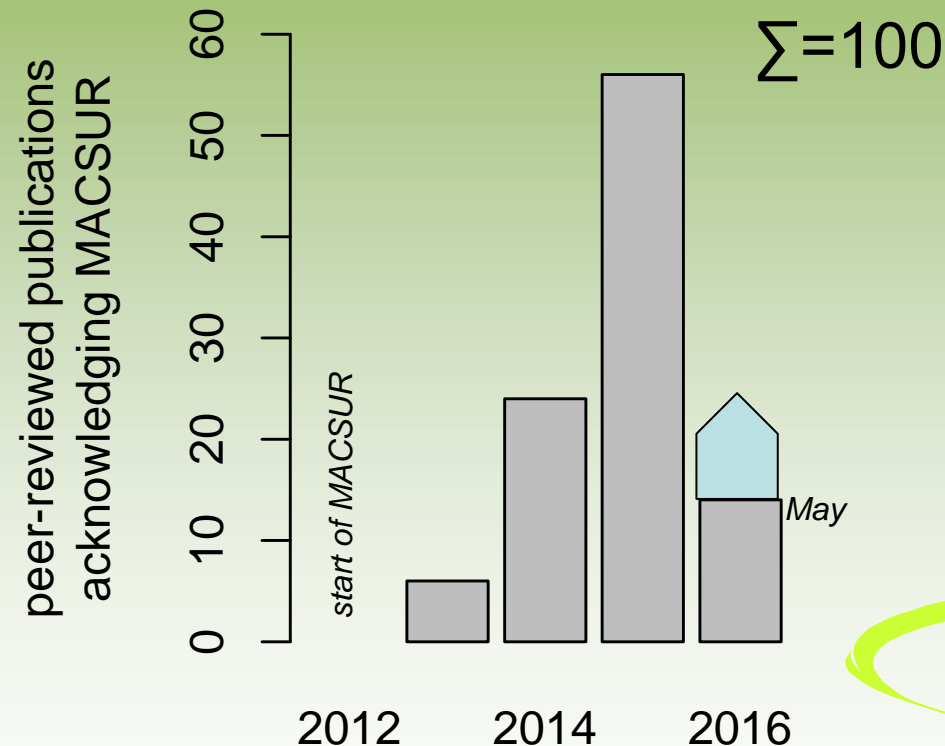
Peer reviewed articles (reviews and original research) acknowledging MACSUR, based on Web of Science and additional information and as of May 2016.
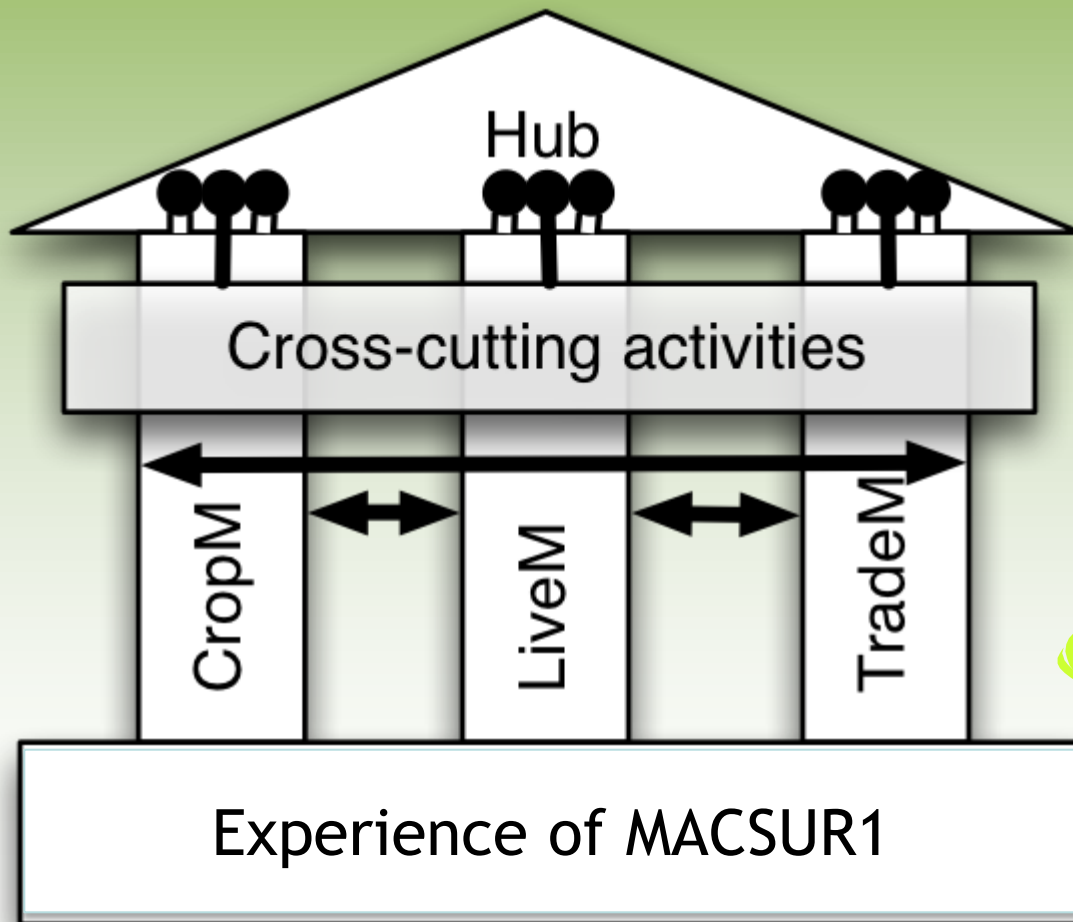
Knowledge Hub

- An instrument building on the concept of "Networks of excellence"

- Brings together **research groups** *that already have funding* in an thematic area

- The support given can be **coordination costs, travel expenses and thematic workshops**.

- Countries may choose to support research and/or mobility.

MACSUR2: Work in XC Activities

Organisation

- Project Steering Committee (3 × 2 + 2)
  ↳ Project Leadership Team (3 × 1 + 2)

- Theme Leaders
  — WP leaders
    - Task leaders ⇒ Cross-cutting activities
      — Collaborators

Contact us

FACCE MACSUR

Modelling European Agriculture with Climate Change for Food Security
– a FACCE-JPI knowledge hub –

Project Steering Committee
***Project Leadership Team (PLT)**: M. Banse, F. Brouwer, Ch. Foyer, R. Rötter, N. Scollan*
F. Ewert, A. Bannink, F. Sinabell | *Management*: M. Köchy

XC1: Model comparison and improvement
• G. Bellocchi

XC2: Scaling
• F. Ewert

XC3: Uncertainty and risk assessment
• E. Haas

XC4: Capacity building
• E. Saetnan

XC5: Interaction with stakeholders
• PLT, M. Köchy

XC6: Regional case studies
• P. Roggero, G. Dono, T. Dalgaard

XC7: Impact assessment for Europe
• A. Zimmermann, Th. Heckelei, F. Ewert, S. Rolinski

XC8: Understanding the impacts of extreme events • R. Tiffin

XC9: Identifying sustainable opportunities to close yield gaps in Europe • M. van Ittersum, R. Schils

XC10: Contributions of new technologies to adaptation and mitigation (T3.3) • NN

XC11: The animal feed story (feed quality, feed utilisation and protein availability) • B. Ammon, A. Bannink

XC12: Farm-scale risk assessment
• in C3, L1, T2

XC13: Impact of consumer behaviour (T3.6)
• A. Milford

XC14: Impacts on ecosystem services and rural development • K. Helming

XC15: GHG mitigation from agriculture
• E. Haas

XC16: Overall scenario development • A. Biewald, H. Lotze-Campen

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TradeM • F. Brouwer, F. Sinabell
Management: F. Brouwer/F. Sinabell

T1: Model comparison and improvement
• F. Sinabell

T2: Scientific advancements supporting integrated assessment approaches • Ø. Hoveid

T3: Cross-cutting issues in hot-spot areas
• G. Dono

T4: Capacity building in integrated modelling and policy assessment • E. Schmid

The MACSUR community consists of c. 300 researchers in 18 countries.

MACSUR started in June 2012 and is currently funded till May 2017.

LiveM • N. Scollan, A. Bannink
Management: R. Kipling

L1: Grassland and farm-scale modelling
• G. Bellocchi

L2: Livestock productivity
• N. Lacetera

L3: XC activity tasks led by LiveM
• R. Kipling

MACSUR aims at
• collaboration across scientific disciplines,
• interacting with decisionmakers, farmers, and agrifood chain
• capacity building of junior and senior scientists
• applying methods in regional case studies
• providing a pan-European assessment of CC impacts on agriculture

CropM • F. Ewert, R. Rötter
Management: K. Brüser

C1: Model comparison and improvement
• C. Kersebaum, M. Bindi

C2: Data management, analysis and presentation
• J. Olesen, M. Trnka

C3: Methods of scaling and model linking
• F. Ewert, S. Janssen

C4: Uncertainty and risk assessment
• R. Rötter, M. Semenov, D. Wallach

C5: Capacity building
• J.R. Porter

C6: Cross-cutting issues
• P.P. Roggero, R.B. Matthews

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F. Ewert, A. Bannink, F. Sinabell | *Management*: M. Köchy

XC (Cross-cutting) Activities

- **XC5: Interaction with stakeholders** • PLT, M. Köchy
- **XC1: Model comparison and improvement** • G. Bellocchi
- **XC16: Overall scenario development** • A. Biewald, H. Lotze-Campen
- **XC12: Farm-scale risk assessment** • in C3, L1, T2
- **XC14: Impacts on ecosystem services and rural development** • K. Helming
- **XC11: The animal feed story (feed quality, feed utilisation and protein availability)** • B. Ammon, A. Bannink
- **XC8: Understanding the impacts of extreme events** • R. Tiffin
- **XC10: Contributions of new technologies to adaptation and mitigation** (T3.3) • NN
- **XC13: Impact of consumer behaviour** (T3.6) • A. Milford
- **XC2: Scaling** • F. Ewert
- **XC4: Capacity building** • E. Saetnan
- **XC3: Uncertainty and risk assessment** • E. Haas
- **XC6: Regional case studies** • P. Roggero, G. Dono, T. Dalgaard
- **XC7: Impact assessment for Europe** • A. Zimmermann, Th. Heckelei, F. Ewert, S. Rolinski
- **XC9: Identifying sustainable opportunities to close yield gaps in Europe** • M. van Ittersum, R. Schils
- **XC15: GHG mitigation from agriculture** • E. Haas

TradeM • F. Brouwer, F. Sinabell

T1: Model comparison and improvement • F. Sinabell
- T1.1: Contributions to XC1 • F. Brouwer
- T1.2: XC16.1 Stakeholder-centered expectations • F. Brouwer
- T1.2: XC16.2 Developing a general framework for RAPs • A. Biewald
- T1.2: XC16.4 Specifying the scenarios for the case studies • M. Schönhart
- T1.3: Interaction with international networks • F. Brouwer
- T1.4: Dissemination activities • F. Brouwer

T2: Scientific advancements supporting integrated assessment approaches • Ø. Hoveid
- T2.4: XC9.2 Explaining yield gaps in Europe • A. Zimmermann
- T2.4: XC9.3 Sustainable options to reduce yield gaps • H. Lehtonen
- T2.5: Farm-scale risk assessment • NN
- T2.6: XC14.1 Analytical framework and indicators for ecosystem service assessment • K. Helming
- T2.6: XC14.2 Mapping of model outputs from the European Assessment and from the regional case studies • M. Schönhart
- T2.6: XC14.3 Definition of gaps in ecosystem service assessment • M. Schönhart

T3: Cross-cutting issues in hot-spot areas • G. Dono
- T3.1: XC6.1 Integrated assessment modelling at the regional case study scale • K. Mittenzwei, P.P. Roggero
- T3.2: XC7.1/163 Common baselines for integrated EU-wide impact assessment • A. Zimmermann, Th. Heckelei
- T3.2: XC7.4 Integrated EU-wide impact assessment of ensemble runs • A. Zimmermann, Britz
- T3.2: XC7.5 Deepening of the EU-wide analysis with regional/national crop, livestock and economic models • H. Lehtonen
- T3.2: XC7.6 Methodology and analysis of impacts that cannot be modelled → XC14.1
- T3.3: Contributions of new technologies • TBA
- T3.6: Impact of consumer behaviour • A. Milford

T4: Capacity building in integrated modelling and policy assessment • E. Schmid
- T4.1: XC4.3 Course on agricultural production and environmental modeling • E. Schmid
- T4.2: XC4.4 Co-operation in capacity building activities with international partners • E. Schmid

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LiveM • N. Scollan, A. Bannink

L1: Grassland and farm-scale modelling • G. Bellocchi
- L1.1: Modelling grassland vulnerability to climate change • G. Bellocchi
- L1.2: Modelling grassland quality under climate change • P. Virkajärvi
- L1.3: Bringing together grassland and farm-scale modelling • M. Höglind
- L1.4: Reusing and linking models in livestock farming • N. Hutchings

L2: Livestock productivity • N. Lacetera
- L2.1: Impacts of climate change on animal health, disease and productivity • N. Lacetera
- L2.2: Impacts of impaired health, disease and productivity change on GHG emissions • S. Özkan
- L2.3: Modelling adaptation to climate change • K. Topp
- L2.4: Modelling the impact of climate change on livestock productivity at the farm-scale • J. van Middelkoop, A. Wilson

L3: XC activity tasks led by LiveM
- L3.1: XC1.2 General framework for model evaluation and comparison • G. Bellocchi
- L3.2: XC4.1 Development of integrated training strategy • E. Saetnan
- L3.3: XC6.2 Comparison of case studies including development of criteria of comparison • T. Dalgaard
- L3.4: XC7.3 Providing ensembles of EU-wide/global consistent sets of grassland yield changes • S. Rolinski
- L3.5: XC11.1 Overview on studies and research activities relevant for the animal feed story and development of region-specific livestock diets • A. Bannink
- L3.6: XC11.2 Suggestion of future livestock diets under conditions of climate change and reduction of protein imports • A. Bannink
- L3.7: XC14.4 Development of options to improve ecosystem service assessments in MACSUR scenario assessments • A. Whitmore
- L3.8: XC15.2 Evaluation of mitigation vs. adaptation strategies • N. Gengler

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- capacity building of junior and senior scientists
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- providing a pan-European assessment of CC impacts on agric.

CropM • F. Ewert, R. Rötter

C1: Model comparison and improvement • C. Kersebaum, M. Bindi
- C1.1: Model response to variable site conditions on crop production and ecosystem services • C. Kersebaum
- C1.2: Data management, analysis and presentation • M. Trnka
- C1.3: Long termeffects of management and cropping systems on crop production and ecosystem services • J. Olesen
- C1.4: Extend crop model assessment to more cropping systems • M. Bindi
- C1.5: Incorporation of diseases and pests in crop models • S. Savary
- C1.6: XC1.1 Survey on model improvement needs • M. Bindi
- C1.7: XC1.3 Establishing links to other research activities • E. Haas

C2: Data management, analysis and presentation • J. Olesen, M. Trnka
- C2.1: Data compilation, management and presentation • S. Janssen
- C2.2: Climate change scenarios • M. Semenov
- C2.3: Quantify gaps for crop modelling • J. Olesen
- C2.4: Observed adaptation options and their efficacy • M. Trnka
- C2.5: Empirical analyses of crop responses to climatic variation • J. Olesen

C3: Methods of scaling and model linking • F. Ewert, S. Janssen
- C3.1: Review progress in scaling methods and supervision of activities in WP C3 • F. Ewert
- C3.2: Development of a joint data sharing mechanism for scaling exercises • S. Janssen
- C3.3: Comparison of scaling methods • F. Ewert
- C3.4: Evaluation of scaling methods for other crops, regions and impact variables • F. Ewert
- C3.5: Application of scaling crop models for integrated assessment of climate change impacts in Europe • F. Ewert
- C3.6: XC2.1 Inventory of scaling methods across crop, farm and economic models • F. Ewert, C. Hoffmann

C4: Uncertainty and risk assessment • R. Rötter, M. Semenov, D. Wallach
- C4.1: Comprehensive framework for assessment of error and uncertainty in crop model predictions • D. Wallach, D. Cammarano
- C4.2: Best practices for building and analyzing the results of multi-model ensembles • D. Wallach
- C4.3: Analysing model sensitivity to perturbations in climate variables with a large crop model ensemble using impact response surfaces • R. Rötter
- C4.4: Probabilistic ensemble-based assessment of region-specific adaptation options • M. Ruiz-Ramos
- C4.5: Crop ideotyping for future conditions using single/multiple crop models • M. Semenov
- C4.6: Model uncertainty quantification • E. Haas
- C4.7: XC3.1 Overview on studies and research activities relevant to uncertainty • E. Haas
- C4.8: XC3.2 Establishing links to other research activities in the field of uncertainty assessment and quantification • E. Haas

C5: Capacity building • J.R. Porter
- C5.1: Continuation of provision of PhD courses for interested students and post-docs • J.R. Porter
- C5.2: XC 4.2 Development of a multidisciplinary e-learning course aimed at MSc and PhD students • J.R. Porter

C6: Cross-cutting issues • P.P. Roggero, R.B. Matthews
- C6.1: XC6.3 Synopsis of case studies from a European perspective and comparison with results by XC7 • P.P. Roggero, T. Dalgaard
- C6.2: XC7.2 Providing ensembles of EU-wide/global consistent sets of crop yield changes • F. Ewert
- C6.3: XC9.1 Quantifying yield gaps • M. van Ittersum, R. Schils
- C6.4: XC15.1 Overview on studies and research activities relevant for GHG mitigation in crop, feed and livestock production • E. Haas
- C6.5: XC15.3 Establishing links to other GHG mitigation activities • E. Haas

Knowledge Hub: Strengths

- Multidisciplinary topics
- Interaction with other disciplines
  - exchange of knowledge, views, approaches
- Greater visibility, global collaboration
- Collaboration with external stakeholders (food chain, decision makers)
- Greater pool for new collaborations
- Resource for capacity building

Knowledge Hub: Weaknesses

- Heterogeneity in funding
  - 0-1 M€/country in MACSUR1, for different purposes
  - funding contracts start late and at different dates
  - adds layer of bureaucracy in reporting and admin

- In-kind funding
  - requires bottom-up planning, limits coherence of work
  - limits identification with project and attribution
  - limits available time and staff

- Slow reaction to changes in stakeholder demands

- Few staff for management/coordination

- Preselected partners, limitation of collaboration

Knowledge Hub: Opportunities

- Major societal issue (food-water-energy)
- Funding for an interdisciplinary topic
- Input from stakeholders, relevance
- Collaboration on emerging topics by subgroups

Knowledge Hub: Threats

- Greater attractiveness and precedence of global initiatives
- Variable support of national governments
- Great and many expectations — low input
- Incoherence of external and internal goals, uncertain future

Conclusions

quality, quantity, efficiency, timeliness:

you can't have it all

in-kind funding ⇒ in-kind output

set SMART goals

set priorities

strengthen leadership by bestowing authority

pool funding and its administration

Conclusions

- We can feed 9-10 billion people
- Food supply needs to be increased whilst reducing environmental impact of agriculture
- Need to find options and policies that co-deliver improved food security and improved environmental outcomes
- Some promising supply-side measures (e.g. efficiency improvements) improve food security and reduce environmental impact
- Demand-side measures (e.g. changing diets, waste reduction) are under-researched, for food security and for potential to reduce environmental impact
- We need to change consumption patterns (demand-side measures) – techno-fixes are not enough to make the necessary changes

CLIMATE-SMART Agriculture 2015

Smith (2014a)