

Output	Status	Comment
<i>Work package 1: Innovation research with future-oriented impact analyses</i>		
<i>Activity 1/1: Modelling and mapping direct and indirect impacts of potential promising innovations</i>		
1. GIS-based typology tool (eAtlas)	Completed for Ghana and Malawi	To be completed for the remaining African PARI countries in 2016
2. eAtlas manual	Design of the analytical framework completed. Model's adaptation to Ghana is still being finalized.	To be completed in 2016.
3. Study on the evidence for bottom-up and top-down innovations	Completed. To be published on the PARI webpage, as a ZEF-Discussion Paper <sup>1</sup> and as a journal article (under preparation)	The study required inputs from multiple consortium partners, and has therefore been subject to the availability of data and other inputs. To be completed in 2016
4. Paper presenting an adaptation of MIRAGRODEP to incorporate technology and innovation issues in African agriculture	Completed. To be published on the PARI webpage, as a ZEF-Discussion Paper <sup>1</sup> and as a journal article (under preparation)	The study required inputs from multiple consortium partners, and has therefore been subject to the availability of data and other inputs. To be completed in 2016
<i>Synthesis report of biophysical and bioeconomic modelling approaches</i>		
<i>Activity 1/2: Developing methodologies and concepts for strategic analysis of potentials and prospects</i>		

## Annual Report 2015

Program of Accompanying Research for Agricultural Innovation - PARI

submitted by

Prof. Dr. Dr. hc Joachim von Braun

Center for Development Research (ZEF) of the University of Bonn

in cooperation with PARI Partners to the German Ministry of Economic

Cooperation and Development (BMZ)



## Content

1.	Summary.....	2
2.	The objective of the Program of Accompanying Research for Innovation – PARI .....	3
3.	Current state of project .....	4
3.1.	Name of partner organizations and their focal point.....	4
3.2.	Description of the work undertaken by PARI in the reporting period .....	4
4.	Key results from the reporting period.....	12
4.1.	Products delivered in reporting period (Target-performance comparison) .....	12
4.2.	Benefits resulting from PARI’s achievements in the reporting period.....	14
5.	Plans for accompanying research in 2016.....	16
6.	Collaboration .....	21
6.1.	Collaboration within the PARI consortium.....	21
6.2.	Collaboration with other national and international partners in the frame of PARI’s work ...	21
6.3.	Collaboration with the Green Innovation Centers and their partners.....	22
7.	Information relevant to the project, publication lists and workshop/travel/other activities..	23
7.1.	List of Publications generated under the PARI project in the reporting period.....	23
7.2.	List of recent publications from PARI members of relevance for the PARI project .....	23
8.	The PARI Network.....	24

## 1. Summary

The *Program of Accompanying Research for Agricultural Innovation* (PARI) brings together partners from Africa, India and Germany to contribute to sustainable agricultural growth and food and nutrition security in Africa and India as part of the Green Innovation Centers (GICs) initiative by the German government. The PARI consortium consists of the Center for Development Research (ZEF) / University of Bonn, the University of Hohenheim (UHOH), the Technical University Munich (TUM), the Forum for Agricultural Research in Africa (FARA) and its African partners, the African Growth and Development Policy Modeling Consortium (AGRODEP) and research collaborators in India. In 2015, the main achievements towards PARI's goals include:

### 1. Innovation research with future-oriented impact analyses

- a) *Modelling and mapping direct and indirect impacts of potentially promising innovations*: A GIS-based typology tool (**eAtlas**) was completed for Ghana and Malawi. The tool will allow policymakers, analysts, and other stakeholders to set technology and innovation priorities based on identified productivity and efficiency gaps in each of the target countries. In addition, a **synthesis report of biophysical and bioeconomic modelling approaches** was completed and will be published in 2016.
- b) *Developing methodologies and concepts for strategic analysis of potentials and prospects*: An **Africa-wide study** was conducted to identify strategic directions for German development investment in the agriculture and food sector in Africa. In addition, a **country dossier** for each of the 12 African PARI countries was developed which describes the state of agriculture innovation in the respective country and value chains and the potentials for German collaboration for agricultural R&D.
- c) *Institutional analysis of the GICs in the context of their national agricultural innovation systems*: **Three comprehensive national studies** were undertaken by each national partner in Africa under the guidance of FARA to provide baseline information on the state of agricultural innovations, existing Innovation Platforms and innovation investments in the respective country. Nine of the 12 countries have submitted their reports and synthesis studies are in progress.

### 2. Identifying and stimulating technological and institutional innovations

- a) *Screening for promising innovations from research and innovation systems ("research proven top-down approach")*: An online **Innovation Database** was developed to collect and share technological and institutional agricultural innovations from PARI's German partner universities as well as leading agricultural universities in the PARI countries.
- b) *Soliciting innovations generated by farmers and other actors in the value chains ("farmer participation bottom-up approach")*: Preparatory work got underway to conduct **farmers' innovation contests** in the PARI countries, which will be launched in 2016.

### 3. Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security

PARI consortium members organized and participated in several events to engage key stakeholders (including high-level policy makers, development partners and academia), discuss research activities and develop the work plan. The PARI website was launched to support outreach and collaboration.

At the level of the GICs, their partners and their target groups and regions, the achievements of PARI's work have shown first benefits: The country dossiers were well received as supportive tools for the GICs. Coordination was strengthened through participation of GIC staff in PARI events and vice versa. PARI members have also been visiting the GICs in the reporting period and established or intensified the linkages between the innovation system of the country with the GICs and their partners.

## 2. The objective of the Program of Accompanying Research for Innovation – PARI

The objective of the Program of Accompanying Research for Agricultural Innovation (PARI) is to secure and enhance investments in the agricultural innovation for food security in a sustainable way by means of dedicated cooperation between research and application. The underlying concept of PARI supports the overall implementation of the Green Innovation Centers (GICs), as an accompanying research program. Based on this concept, PARI offers independent scientific advice to BMZ' plans and activities related to the GICs as part of the special initiative of the German Government "One world without hunger" (SEWOH). Hence, PARI:

1. Supports and improves the work of existing African and Indian agricultural innovation institutions;
2. Provides information for stakeholder (incl. government) consultations on agricultural policy and trade, institutional capacity building, rural infrastructure and value chains as well as regional resource management;
3. Provides inputs for the selection of promising innovation domains in the respective contexts;
4. Accompanies specified innovations at the GICs with impact research and identifies further innovation opportunities incl. those expressed by end users of research in collaboration with the multi-stakeholder Innovation Platforms;
5. Fosters synergies with and links to existing innovation centers in the respective countries' innovation systems.

PARI operates on the basis that institutional and policy analyses provide a sound foundation in the various countries for establishing appropriately adapted and promising organizational leadership of the GICs. PARI is not operating as an implementing agency of the overarching investment program for the GICs. However, with the generated research-based information it serves to strengthen the integration of the GICs into the national, regional and continental institutional partner settings to enhance value chains and rural and agricultural development. In doing so, PARI is providing relevant information to key actors in the overarching program, who are in charge of the actual implementation of the GIC program (e.g. to the respective GICs) and also to the national and regional partners in Africa and India. The core topics and thematic research priorities of PARI are being identified in accordance with the African Union's CAADP as part of the New Partnership for Africa's Development (NEPAD) and the Indian partners.

PARI brings together partners from Africa, India and Germany to contribute to sustainable agricultural growth and food and nutrition security in Africa and India. The program is being implemented by an international, interdisciplinary consortium of three universities (ZEF / University of Bonn, University of Hohenheim, Technical University Munich), the Forum for Agricultural Research in Africa (FARA), and its network of national and regional partners in Africa, and the African Growth and Development Policy Modeling Consortium (AGRODEP) facilitated by the International Food Policy Research Institute (IFPRI, Africa Office), and research collaborators in India.

### 3. Current state of project

#### 3.1. Name of partner organizations and their focal point

Partner organizations	Focal point
<ul style="list-style-type: none"> <li>- <b>ZEF</b> Center for Development Research University of Bonn</li> </ul>	<p>Prof. Dr. Joachim von Braun Project Director, and Dr. Detlef Virchow, Project Coordinator</p>
<ul style="list-style-type: none"> <li>- <b>AGRODEP</b> African Growth and Development Policy Modeling Consortium International Food Policy Research Institute (IFPRI)</li> </ul>	<p>Dr. Ousmane Badiane IFPRI Director for Africa</p>
<ul style="list-style-type: none"> <li>- <b>FARA</b> Forum for Agricultural Research in Africa</li> </ul>	<p>Dr. Yemi Akinbamijo Executive Director, and Dr. Wole Fatunbi, Project Coordinator at FARA</p>
<ul style="list-style-type: none"> <li>- <b>TUM</b> School of Life Sciences Weihenstephan Technical University of Munich</li> </ul>	<p>Prof. Dr. Angelika Schnieke Dean's office</p>
<ul style="list-style-type: none"> <li>- <b>UHOH</b> University of Hohenheim</li> </ul>	<p>Prof. Dr. Regina Birner Head of Social and Institutional Change in Agricultural Development</p>

#### 3.2. Description of the work undertaken by PARI in the reporting period

Based on the above-described concept, PARI's specific goals are (i) to support and enhance investments in the GICs through research; (ii) to promote and support the scaling of proven innovations in the agri-food sector serving food security in collaboration and partnership with all relevant actors and thereby to (iii) contribute to the development of the agri-food sector in Africa and India through the identification, assessment and up-scaling of innovations. To implement these goals, PARI's collaborative work is divided into three main fields of accompanying research (work packages):

1. Innovation research with future-oriented impact analyses, such as:
  - modelling and mapping direct and indirect impacts of potentially promising innovations
  - developing methodologies and concepts for strategic analysis of potentials and prospects
  - institutional analysis of the GICs in the context of their national agricultural innovation systems;
2. Identifying and stimulating technological and institutional innovations, such as:
  - screening for promising existing innovations from research and innovation systems
  - soliciting innovations generated by farmers and other actors in the value chains
  - scaling of innovations;
3. Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security.

## Work package I: Innovation research with future-oriented impact analyses

PARI is assessing contributions of innovations with impact to sustainable agricultural growth and food and nutrition security. The analyses-based information is supplied to BMZ, the GICs and all actors of the technical and organizational implementation of the overall program for potential target-orientated adaptation of the program.

### Activity I/1: Modelling and mapping direct and indirect impacts of potential promising innovations

PARI is using transparent quantitative modeling for identifying the direct and indirect impacts of investments into innovations on production, productivity and improved food security of the population. Activity 1 provides spatial GIS-based, economic and crop modeling tools to help understand where the best opportunities for innovation investments in value chains are and what their potential effects could be, and facilitate access to the data needed for these models. This activity serves to show opportunities across GICs and across countries, and therefore helps learning from and scaling of GIC investments.

**Mapping the opportunities:** During the reporting period, the AGRODEP team started developing the **eAtlas**, which aims at supporting evidence-based policy planning and implementation and inclusive policy review and learning processes in countries covered by PARI in Africa. To this end, the team designed a server infrastructure for the online over-laying of data records on e.g. agriculture, socioeconomic, basic biophysical and climate data with a focus on routine preprocessing functions such as data filtering, time series and anomaly generation, reformatting, sub-setting, and bundling. The team also developed an intuitive and rich web-based client application for 21 countries, including all 12 countries covered by PARI in Africa. The application supports interaction with the data records using the latest data preprocessing best practices and tools. Thereby, the eAtlas will serve as an important GIS-based mapping tool for policymakers, analysts, and other stakeholders. The team is now reaching out to individual countries for the validation of the country-sourced data before making the eAtlas publicly available.

**Farming focus:** The work on **rural typology** of micro-regions serves to identify micro-regional level opportunities, bottlenecks and investment gaps based on the concept of the production possibilities frontier applied to farm activities, drawing on highly detailed household-level survey and geospatial data on agro-ecological conditions, accessibility and poverty. During this reporting period the basic typology approach was adapted to the project's objectives, household survey and GIS data were obtained for 5 of the 12 African countries relevant to PARI, and preliminary versions of the typology were finalized for 2 countries (Ghana and Malawi). In 2016, data for the remaining countries will be secured and typologies for the full set of countries will be estimated and validated.

**Agriculture in systems and economy wide context:** A study was conducted on "The use of **agricultural system models** for exploring technological innovations across scales in Africa". This study includes results from three systematic reviews on ex-ante evaluation of the effects of (agro-) technological innovations on sustainable agriculture and food security indicators: one on the use of biophysical modelling, the second and third on the use of bio-economic modelling at farm scale and agro-economic modelling at higher aggregation levels. It has been shown that there is no application yet of true transdisciplinary research approaches in practice. Hence, there is need for participatory, collaborative (cross-sectoral) and combined modelling approaches with adequate stakeholder involvement throughout the research process. In this respect, some lessons might be learned from pioneering work conducted in Asia and Europe.

The **economic modelling** team has designed an analytical framework to implement the technological scenarios for the PARI project. The MIRAGRODEP Computable General Equilibrium (CGE) model has started to be modified and specific templates were developed for the new data requirements and the scenario inputs. Ghana was taken as a prototype country before expanding the framework to other PARI countries in 2016. The specific activities during the reporting period

consisted of transforming the MIRAGRODEP model in order to work at the subnational level (using agro-ecological zones and homogenous production units). The aim is to make a link with both the eAtlas and the typology data.

In addition, a technological shifter module is also being developed to make the link with **crop models**. On the data side, a regional social accounting matrix for Ghana has been obtained and analyzed in order to be integrated with the MIRAGRODEP model. In addition, a template was also developed for data coming from the other components (such as the eAtlas). To link up-scaled **crop models** with national and continental scale economic models is another task in this activity. Main activities in the reporting period focused on model development for simulation of heat and drought stress and long-term crop phenology data analysis at large scale. Furthermore, model inputs for Africa were gathered. The Africa wide climate (daily precipitation, temperature, radiation and wind speed) and soil data were obtained and converted to crop model compatible format.

#### **Deliverables of Activity I/1:**

1) Development of a **GIS-based typology tool** linked to a simulation model allowing to set technology and innovation priorities based on identified productivity and efficiency gaps in each of the target countries (eAtlas).

*This deliverable was achieved for Ghana and Malawi. The agricultural typologies for all 12 PARI countries are scheduled to be validated and uploaded to the eAtlas in 2016. The eAtlas will be validated and launched in all 12 PARI countries during 2016. In addition, all indicators will be updated during 2016 with the most recent data available.*

Documentation:

Progress report on Agricultural Typologies Work for the Program of Accompanying Research for Agricultural Innovation (PARI) by Maximo Torero and Eduardo Maruyama, Markets, Trade and Institutions Division, IFPRI.

2) Preparation of a **manual** documenting the eAtlas and detailing procedures for its use and updating of its data by national collaborators to set technology and innovations priorities.

*The manual was produced in the form of a detailed video presentation demonstrating the use of the different technical aspects of the eAtlas.*

3) One **study reviewing empirical evidence** for bottom-up and top-down innovations:

*This deliverable will be accomplished in 2016.*

4) One paper presenting an **adaptation of MIRAGRODEP**, a trade-based model from the AGRODEP library (which was earlier used to study the role of infrastructure), in a customized and expanded version to incorporate technology and innovation issues in African agriculture.

*Work to develop the adaptation of the MIRAGRODEP model required inputs from multiple consortium partners, and has therefore been subject to the availability of data and other inputs. However, the design of the analytical framework has been completed, and the model's adaptation to Ghana is currently being finalized and AGRODEP members will be trained and mentored in 2016 for an application of the tool to all PARI countries.*

5) A **synthesis report of biophysical and bioeconomic modelling approaches** presenting results from three systematic reviews: one on the use of biophysical modelling, the second and third on the use of bio-economic modelling at farm scale and agro-economic modelling at higher aggregation levels, for ex ante evaluation of the effects of (agro-) technological innovations on sustainable agriculture and food security indicators.

*This deliverable was achieved and will be published on PARI's webpage and as ZEF-Discussion Paper and an article will be submitted to a journal soon.*

Documentation:

ZEF - Discussion Paper (in print): On the use of agricultural system models for exploring technological innovations across scales in Africa: A critical review.

Reimund P. Rötter, Fanou L. Sehomi, Jukka G. Höhn, Jarkko K. Niemi and Marrit van den Berg.

### **Activity I/2: Developing methodologies and concepts for strategic analysis of potentials and prospects**

PARI develops a methodology and a standardized concept, which allows strategic analysis and visioning as well as the assessment of the impact of the various investments in the Green Innovation Centers.

In order to identify strategic directions for German development investment in the agriculture and food sector in Africa, an **Africa-wide study** was conducted by ZEF, AGRODEP and FARA. Criteria and principles are proposed in line with good development practice as specified by development partners (Accra principles etc.) emphasizing partner countries leadership, and also considering specifics of high expected returns to investment for sustainable agricultural growth and food security. The records and potentials of 42 African countries were reviewed accordingly, using comprehensive assessments of agronomic, economic and governance criteria that can be transparently tracked. This broad based assessment can support policy dialog.

Based on country studies developed by FARA for the 12 participating African countries in PARI, a country dossier for each of these countries was developed. These **country dossiers** describe the state of agriculture innovation in the relevant countries, the level of innovation research in the relevant value chains and the potentials for German collaboration for agricultural research and development. This was a collaborative assignment with research partners in ZEF, FARA and the national partners in the 12 countries. The dossiers are considered “living documents” and will be further developed during 2016. Work is ongoing for the country dossier for India, which will be online in 2016.

#### **Deliverables of Activity I/2:**

1) An **Africa-wide study** on identifying strategic directions for German development investment in the agriculture and food sector in Africa.

*This deliverable was achieved and published on PARI's webpage and as ZEF Working Paper.*

Documentation:

ZEF Working Paper 144: Husmann, C., von Braun, J., Badiane, O., Akinbamijo, Y., Abiodun, F.O. and D. Virchow. 2015. Tapping Potentials of Innovation for Food Security and Sustainable Agricultural Growth: An Africa-Wide Perspective.

[http://www.zef.de/uploads/tx\\_zefportal/Publications/zef\\_wp\\_144.pdf](http://www.zef.de/uploads/tx_zefportal/Publications/zef_wp_144.pdf)

2) 12 **country dossiers** for each of the involved African countries describing the state of agriculture innovation in the relevant countries, the level of innovation research in the relevant value chains and the potentials for German collaboration for agricultural research and development.

*This deliverable was achieved and published on PARI's webpage.*

Documentation:

12 country dossiers on Potentials and Possibilities for German Collaboration in Agriculture. Contributors from FARA (Yemi Akinbamijo, Fatunbi Oluwole Abiodun), ZEF (Heike Baumüller, Joachim von Braun, Annapia Debarry, Katharina Gallant, Tigabu Degu Getahun, Christine Husmann, Hannah Jaenicke, Oliver K. Kirui, Ehsan Eyshi Rezaei, Yasmin Smith,



Justice Akpene Tambo, Detlef Virchow, Katharina Zinn) and from the national agricultural research institutes of the countries.

[http://research4agrinnovation.org/publication/country\\_dossiers/](http://research4agrinnovation.org/publication/country_dossiers/)

*The study reviewing the level of innovation research in the value chains of the relevant countries was not compiled as a stand-alone report, but the content was incorporated into the 12 country studies.*

3) In addition to the planned deliverables for 2015 under this activity, a PARI related paper was published on the **role of regional trade** in fostering the resilience of domestic food markets among African countries within Regional Economic Communities, including the Common Market for Eastern and Southern Africa (COMESA), the Economic Community of West African States (ECOWAS), and the Southern African Development Community (SADC).

Documentation:

Ousmane Badiane and Sunday Odjo, Regional trade and volatility in staple food markets in Africa, ZEF-Discussion Papers on Development Policy No. 200, Center for Development Research, Bonn, June 2015, pp. 36.

[http://www.zef.de/uploads/tx\\_zefportal/Publications/zef\\_dp\\_200.pdf](http://www.zef.de/uploads/tx_zefportal/Publications/zef_dp_200.pdf)

### **Activity I/3: Institutional analysis of the GICs in the context of their national agricultural innovation systems**

The impact of GICs will be enhanced and sustained, if connected well with, and building on related other investment initiatives in the countries and regions, where GICs are operating. To this end, PARI conducts analyses of innovation activities in the environment in which the GICs perform. A particular focus is on the sustainability of the GIC program for the post-funding period. This includes the analysis of the institutional cooperation and integration of the GICs into existing innovation systems (incl. Innovation Platforms) of the respective countries. In the reporting period, **three comprehensive studies** were conducted under PARI by each national partner under the guidance of FARA. The studies provide baseline information on the state of agricultural innovations in the respective country. Based on these studies, FARA conducted three synthesis studies:

a) Synthesis on the state of agricultural innovations in the 12 countries in SSA:

The studies provide background information and data on the state of agricultural innovations at the country levels.

b) Scoping study of the existing agricultural Innovation Platforms in the countries:

The second study achieved the documentation of the existing Innovation Platforms in the countries including identification of commodity focus, system configuration and partnership model. The study also offers lesson learnt from agricultural Innovation Platforms that were established through different initiatives in the country in the last ten years.

c) Assessment study on the national and international investment in agricultural innovation.

The third study provided an exhaustive assessment of investments in innovation for agricultural development and food and nutrition security in the country.

#### **Deliverables of Activity I/3:**

1) **Synthesis on the state of agricultural innovations** in the 12 countries in SSA.

*Nine of the 12 countries have submitted their study to FARA and the synthesis study is in progress. This deliverable will be finalized in 2016.*

2) **Scoping study of the existing agricultural Innovation Platforms** in the countries.

*Nine of the 12 countries have submitted their study to FARA and the synthesis study is in progress. This deliverable will be finalized in 2016.*

**3) Assessment study on the national and international investment initiatives** on innovation for development and food and nutrition security in Africa.

*Nine of the 12 countries have submitted their study to FARA and the synthesis study is in progress. This deliverable will be finalized in 2016.*

## **Work package II: Identifying and stimulating technological and institutional innovations**

This component of PARI identifies promising innovations for the agricultural and food sector along the value chains and markets in the respective national and regional context of the GICs. It also takes into account previous experiences with innovations from African, international and German partners. Furthermore, it advises on linkages with appropriate partners to facilitate that identified technological and institutional innovations are used by end users in reaching identified or targeted markets.

### **Activity II/1: Screening for promising innovations from research and innovation systems (“research proven top-down approach”)**

Scientists (especially doctoral students) at PARI’s German partner universities and at leading agricultural universities in the countries served by PARI have generated original empirical research in a wide range of areas, developing specific technological and institutional agricultural innovations or assessing such innovations. The aim of the **PARI Innovation Database** is to get this off the shelves and tap into this wealth of knowledge to identify and document the most promising agricultural innovations that have the potential to be scaled up in developing countries in general and especially across the PARI countries in Africa and India.

In the first phase, an Excel-based screening template was developed and tested by ZEF, UHOH and TUM. The template collects information about the innovations, including a detailed description, impacts, requirements for adoption and contact information. Among the listed innovations, the most promising are then described in more detailed factsheets. PARI identified and entered 119 innovations in the first round. Work began in 2015 to build an online searchable database to facilitate data entry and make the innovations widely accessible. Once completed, PARI will approach relevant universities in the partner countries to solicit their input. (The database is scheduled for completion in May 2016).

#### **Deliverables of Activity II/1:**

1) An **Excel-based screening template** with information about the identified innovations, including a detailed description, impacts, requirements for adoption and contact information.

Documentation: PARI internal files

2) Detailed **Fact Sheets** for most promising innovations (e.g., solar dryers, milk cooling system, pant oil pressure stove)

Documentation: PARI internal files

3) **PARI Innovation Database** online, including the information from the Excel-based screening template and the fact sheets.

*This deliverable was achieved (early 2016) and is accessible online through PARI’s webpage.*

Documentation: <http://database.research4agrinnovation.org/>

## **Activity II/2: Soliciting innovations generated by farmers and other actors in the value chains ("farmer participation bottom-up approach")**

Farmers are innovators themselves. One component of PARI focuses on identifying high-potential local innovations in the countries through appropriately designed competitive **farmers' innovation contests** that harvest innovations in participatory manners with farmer innovators, and facilitates sharing them with farming communities. Farmers engaged in production under varied agro-ecological conditions are continuously facing numerous and often very diverse challenges, such as climate change, pests and diseases, and soil degradation. Consequently, blanket recommendations of externally-driven innovations may not be appropriate for all conditions. Local innovations developed by farmers could complement those developed by public and private research institutions in addressing location-specific challenges. Some of these local innovations also have the potential to be improved and disseminated to farmers in other regions. It is therefore imperative to support these bottom-up innovations, and identifying some promising local innovations can serve as a starting point. ZEF research in Ghana has shown innovation contests, in which awards serve as incentives to overcome innovation secrecy and encourage farmers to share their newly developed practices, to be a good instrument in scouting local innovations. This approach will now be rolled out in the PARI countries. In 2015, ZEF prepared this "bottom-up" approach by engaging with the national partners in Africa who under the coordination of FARA and ZEF will take the lead in implementing the contest in all countries.

### **Deliverables of Activity II/2:**

*No deliverables were planned for this activity in 2015. Preparation of the implementation of the "farmer participation bottom-up approach" took place in 2015.*

## **Work package III: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security**

During 2015, PARI organized or participated in several policy-relevant meetings and conferences in Germany and Africa and PARI partners engaged in policy consultations by providing research insights. The most important ones are listed here:

February 23-24: **High-Level Planning Meeting** on: Scaling agricultural innovations in Africa. Nairobi, Kenya

Organized by FARA

The goal of the high-level meeting was to lay the foundation for relevant partners' support and buy-in through an exchange of information on the initiative and its implementation road map in the 12 participating countries in Africa. The meeting was attended by high-ranking government officials (e.g., Her Excellency Mrs. Tumusiime Rhoda Peace, Commissioner for Rural Economy and Agriculture of the African Union, Honourable Felix Kiptarus Koskei, Cabinet Secretary, Ministry of Agriculture, Livestock and Fisheries, Republic of Kenya), Senior Level Policy Makers and Heads of Agricultural Research Institutions from the national research partners, and delegates from BMZ (among others: Dr. Stefan Schmitz), ZEF, TUM and UHOH.

Documentation: PARI proceedings

March 23-25: Expert meeting on the special initiative "SEWOH" and **co-meeting of the Montpellier Panel**. Berlin, Germany.

Organized by BMZ and the Montpellier Panel

In the frame of BMZ' special initiative "SEWOH" an expert meeting was held to discuss the potentials of achieving a world without hunger. Special guests were representatives of

the Montpellier Panel, which had its annual meeting in Berlin. Participants of the Montpellier Panel present in Berlin are also involved in PARI's work: Sir Gordon Conway, Tom Arnold, Ousmane Badiane, Joachim von Braun, Namanga Ngongi, Oumar Niangado, Lindiwe Sibanda, Ramadjita Tabo.

August 12: Innovation for agricultural growth, food security and nutrition in Africa and South Asia. Milano, Italy.

Organized by ZEF

The **Invited Panel Session** during the 29th International Conference of Agricultural Economists (ICAE) in Milan aimed to assess the impacts of initiatives for innovation in support of growth, food security and nutrition in Africa and South Asia. Invited were young scientists working on the different aspects of innovation in agriculture.

September 01-03: Harmonization of Methodology for Country Studies in the Program of Accompanying Research for Agricultural Innovation. Addis Ababa, Ethiopia.

During the Annual Conference 2015 of ReSAKSS (Regional Strategic Analysis and Knowledge Support System) FARA organized a **side event** to foster the harmonization of the methodologies for the implementation of the three baseline studies in the countries (see I/3) besides providing an overview of PARI. In addition to FARA and the national partners, representatives from AGRODEP and ZEF were participating from PARI.

Documentation: PARI proceedings

November 10-12: **PARI Annual Research and Planning Meeting 2015**. Bonn, Germany

Organized by ZEF and FARA

The objectives of the meeting were to report the activities and outputs achieved in 2015 and to plan and harmonize the research activities for 2016. In addition, the national partners presented findings from the 3 national studies to all PARI members regarding the (i) trends in the agricultural and food sector of the countries; (ii) the lessons learned from Innovation Platforms in the countries and (iii) the national and international investment initiatives on innovation for development and food and nutrition security in Africa. Furthermore, one day was reserved for discussion on the modelling of agricultural innovation opportunities and the scope for mutual learning between agronomic and economic innovation modelling and how to drive modelling towards policy and practitioners' advice. In addition, all participants visited BMZ and had a discussion with Dr. Stefan Schmitz and Mrs. Ulrike Meier.

Representatives of all consortium partners participated in the annual meeting: AGRODEP, FARA, TUM, UHOH and ZEF as well as participants from 11 of the 12 African countries and guests from GIZ and DIE.

Documentation: PARI proceedings

Finally, **the PARI website** ([www.research4agrinnovation.org](http://www.research4agrinnovation.org)) was launched to promote and facilitate accompanying research for innovation in the agriculture and food sector as well as to facilitate the interaction between PARI consortium members and relevant stakeholders.

#### 4. Key results from the reporting period

##### 4.1. Products delivered in reporting period (Target-performance comparison)

In 2015, PARI commenced its work. While establishing and organizing the institutional collaboration within PARI's consortium (ZEF-AGRODEP-FARA-TUM-UHOH) and between consortium members and their partners (esp. FARA with the lead national agricultural research organization in the 12 countries and the endorsement of the Africa Union commission), the accompanying research work started.

The following table summarizes the deliverables planned for 2015 and their status by the end of the reporting period. In cases where the output is still in progress, an explanation is provided in the third column.

Output	Status	Comment
<b>Work package I: Innovation research with future-oriented impact analyses</b>		
<b>Activity I/1: Modelling and mapping direct and indirect impacts of potential promising innovations</b>		
1. GIS-based typology tool (eAtlas)	Completed for Ghana and Malawi.	To be completed for the remaining African PARI countries in 2016.
2. eAtlas manual	Detailed video presentation demonstrating the use of the different technical aspects of the eAtlas.	
3. Study reviewing empirical evidence for bottom-up and top-down innovations	In progress.	Significant progress was made. To be completed in 2016.
4. Paper presenting an adaptation of MIRAGRODEP to incorporate technology and innovation issues in African agriculture	Design of the analytical framework completed. Model's adaptation to Ghana is still being finalized.	The study required inputs from multiple consortium partners, and has therefore been subject to the availability of data and other inputs. To be completed in 2016.
5. Synthesis report of biophysical and bioeconomic modelling approaches	Completed. To be published on the PARI webpage, as a ZEF-Discussion Paper <sup>1</sup> and as a journal article (under preparation).	

<sup>1</sup> Rötter RP, Sehomi FL, Höhn JG, Niei JK and van den Berg M (forthcoming) *On the use of agricultural system models for exploring technological innovations across scales in Africa: A critical review*. ZEF Discussion Paper No. xx

<b>Activity I/2: Developing methodologies and concepts for strategic analysis of potentials and prospects</b>		
1. Africa-wide study	Completed. Published on the PARI webpage <sup>2</sup> and as a ZEF Working Paper <sup>3</sup> .	
2. 12 country dossiers	Completed. Published on the PARI webpage <sup>4</sup> .	To be updated in 2016.
3. Paper on the role of regional trade	Completed. Published as a ZEF Discussion Paper <sup>5</sup> .	
<b>Activity I/3: Institutional analysis of the GICs in the context of their national agricultural innovation systems</b>		
1. Synthesis on the state of agricultural innovations	9 country studies submitted to FARA. Synthesis study under development.	To be completed in 2016.
2. Scoping study of existing agricultural Innovation Platforms	9 country studies submitted to FARA. Synthesis study under development.	To be completed in 2016.
3. Assessment study of relevant national and international investment initiatives	9 country studies submitted to FARA. Synthesis study under development.	To be completed in 2016.
<b>Work package II: Identifying and stimulating technological and institutional innovations</b>		
<b>Activity II/1: Screening for promising innovations from research and innovation systems</b>		
1. Excel-based screening template	Template Completed. 119 innovations entered by ZEF, TUM and UHOH.	To be expanded in 2016.
2. Detailed Fact Sheets for most promising innovations	Drafts completed (internal files).	To be finalized in 2016.
3. Online PARI Innovation Database	Work initiated.	Online in 2016.
<b>Activity II/2: Soliciting innovations generated by farmers and other actors in the value chains</b>		
No deliverables planned for 2015	Preparatory work initiated.	
<b>Work package III: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security</b>		
High-Level Planning Meeting	February 23-24, Nairobi, Kenya	

<sup>2</sup> [http://research4agrinnovation.org/publication/africa\\_study/](http://research4agrinnovation.org/publication/africa_study/)

<sup>3</sup> Husmann C, von Braun J, Badiane O, Akinbamijo Y, Abiodun FO and Virchow D (2015) *Tapping Potentials of Innovation for Food Security and Sustainable Agricultural Growth: An Africa-Wide Perspective*. ZEF Working Paper No. 144, [http://www.zef.de/uploads/tx\\_zefportal/Publications/zef\\_wp\\_144.pdf](http://www.zef.de/uploads/tx_zefportal/Publications/zef_wp_144.pdf)

<sup>4</sup> [http://research4agrinnovation.org/publication/country\\_dossiers/](http://research4agrinnovation.org/publication/country_dossiers/)

<sup>5</sup> Badiane O and Odjo S (2015) *Regional trade and volatility in staple food markets in Africa*. ZEF Discussion Paper No. 200, [http://www.zef.de/uploads/tx\\_zefportal/Publications/zef\\_dp\\_200.pdf](http://www.zef.de/uploads/tx_zefportal/Publications/zef_dp_200.pdf)

Meeting of the Montpellier Panel	March 23-25, Berlin, Germany	
Invited Panel Session at the International Conference of Agricultural Economists	August 12, Milano, Italy	
Side-event at the ReSAKSS Annual Conference 2015	September 1-3, Addis Ababa, Ethiopia	
PARI Annual Research and Planning Meeting 2015	November 10-12 in Bonn, Germany	
PARI website	Online <sup>6</sup>	

#### 4.2. Benefits resulting from PARI's achievements in the reporting period

PARI's consortium structure as well as its work and achievements in the reporting period shows benefits on three levels:

At the *level of the PARI consortium*, the consortium members benefitted from the results generated in the consortium. So for instance:

- The eAtlases developed during the reporting period by AGRODEP provide a comprehensive policy analysis tool for the other consortium members and partners, partly for their work in the frame of PARI and partly for their general work.
- AGRODEP's MIRAGRODEP-AEZ model is being developed with regular input from the other consortium members to ensure that the final model will meet their needs. When developed, the model will allow consortium members to simulate the impacts of potential agricultural innovations in PARI countries at the subnational level. The data generated from the studies in the 12 countries will contribute to the modeling activities in projecting the plausible scenario for agricultural research and development interventions in the countries.
- Fostering collaborative research and accessing policy support for scaling interventions by all PARI consortium members and especially by the German universities, FARA's partnership with the lead national agricultural research organizations in the 12 countries provide the PARI consortium the important linkages with the policy system at the continental level and at the country level.

At the *level of the Green Innovation Centers*, their partners and their target groups and regions, the achievements of PARI's work has shown already benefits:

- The country dossiers for the 12 African countries compiled by PARI and their partners were well received as supportive tools for the GICs.
- PARI's efforts to link the GICs to the innovation systems of the relevant countries started in the reporting period: Leading GIC staff participated in the High-Level Planning Meeting in Nairobi and in PARI's Annual Research and Planning Meeting 2015 in Bonn, and formed a well-functioning network.
- PARI members have been visiting the GICs in the reporting period and established or intensified the linkages between the innovation system of the country (e.g., the National Agriculture Research Institute) with the GICs and their partners.

<sup>6</sup> [www.research4agrinnovation.org](http://www.research4agrinnovation.org)

- It is expected that the GICs will be increasingly utilizing new outputs developed by PARI in 2016. These will include research results on adapted as well as high-science technologies, tools to identify in a systematic manner the regions where investments in agricultural innovations are more likely to yield the highest returns, as well as further collaboration with Innovation Platforms or other institutional settings to scale proven technologies.

At the *level of the national and international partners* and beyond the scope of the special initiative “One world without hunger”, PARI’s activities and outputs have been recognized and the interest in the envisaged outputs are articulated for policy and investment planning, prioritization, implementation, and monitoring and evaluation.



## 5. Plans for accompanying research in 2016

PARI's working structure is organized in such a way that there are some major research themes on-going for the whole three years of the program. These are themes with high importance for innovations in agriculture and the food sector and which need thorough and long-term research work. Other topics are covered on a year-to-year basis, reacting to the needs and questions of BMZ' SEWOH initiative and the innovation research challenges and needs in the partner countries in Africa (and in India from 2016 onwards). Hence, PARI's research plan evolves over the period of the program. During PARI's Annual Research and Planning Meeting, the research topics and collaborations are discussed and a plan is drafted, which is finalized in the weeks following the meeting.

The plan for 2016 is depicted in the following.

Work packages	Activities	Tasks	Deliverables	Implementing partner(s) in the lead of respective task	on-going in 2017
<b>WP I: Innovation research with future-oriented impact analyses</b>					
<b>1: Modelling and mapping direct and indirect impacts of potentially promising innovations</b>					
		Extension of production frontier analysis (from Ghana to all PARI countries).	Study on the production frontier analysis	AGRODEP	
		Launch of eAtlas platform for access and use in all PARI countries by June 2016.	eAtlas launched	AGRODEP	
		Finalization of typology and prioritization analysis and posting on country eAtlases for at least 60% of countries.	Typology and prioritization analysis included in eAtlas	AGRODEP	
		Training and backstopping of AGRODEP members on MIRAGRODEP application for PARI.	Training course	AGRODEP	<b>X</b>

		Training and backstopping of AGRODEP members on production frontier estimation and construction of typologies.	Training course	AGRODEP	X
		Close interaction with crop modeling team to coordinate data and modeling work.	Interim report	AGRODEP	X
		Calibration and up-scaling of crop models; application of up-scaled models; linking the up-scaled crop models with national and continental scale economic models	Study on modelling	ZEF / Bonn University	X
<b>2: Developing methodologies and concepts for strategic analysis of potentials and prospects</b>					
		Enriching Africa-wide study	2 <sup>nd</sup> edition of Africa-wide study	ZEF, AGRODEP, FARA	
		Update of African Country Dossiers	2 <sup>nd</sup> edition of African Country Dossiers, incl. 2-page summaries for each country	ZEF, FARA, National partners	X
		Review on India's potential and country dossier	India Country Dossier	ZEF, Welthungerhilfe and Indian partners	X
<b>3: Institutional analysis of the GICs in the context of their national agricultural innovation systems</b>					
		Assessment of past contributions of countries' Innovation Platforms	Study on impacts of Innovation Platforms in SSA	ZEF, FARA	
		Developing a methodology on how to identify most promising value chains.	Background study	AGRODEP	

		An accompanying socio-economic research integrating nutrition, livelihood strategies and rural labor	<ul style="list-style-type: none"> <li>• Research papers on farm diversification for food security and dietary diversity in 3 PARI countries</li> <li>• Baseline survey</li> </ul>	TUM, national partners in Benin (and Kenya)	<b>X</b>
		ICT in the agri-food sector	<ul style="list-style-type: none"> <li>• Study on m-services in the value chain</li> <li>• Study on m-services / social media and the youth in agriculture</li> <li>• Think piece on Industry 4.0 and African Agriculture</li> </ul>	ZEF	<b>X</b>
		Reviewing evidence on the impacts of private sector investments in the African food and agricultural sector on the local population	Private sector study	ZEF	
		Impact of empowerment of farmers' organizations	Overview paper	ZEF	<b>X</b>
		Study on vocational training	Background study	ZEF	<b>X</b>
		Study on gender and rights assessment	Background study	ZEF	
<b>WP II: Identifying and stimulating technological and institutional innovations</b>					
<b>1: Screening for promising innovations from research and innovation systems</b>					
		Finalizing an online searchable database containing information about agricultural innovations, incl. factsheets about the most promising innovations	PARI Innovation Database launched	ZEF	
		Screening of PHD theses for relevant agricultural innovations	Input into the PARI Innovation Database	ZEF, UHOH, TUM	<b>X</b>
		Screening of research outputs by agricultural universities in the PARI partner countries	Input into the PARI Innovation Database	FARA, ZEF	<b>X</b>

		Assessing the nutritional status by remote phenotyping for individualizing nutrition advice via information and communication technologies	<ul style="list-style-type: none"> <li>• Progress report on partnership and research model and data collection procedures</li> <li>• Updated mobile app for nutrition study</li> <li>• Baseline survey</li> <li>• Preliminary report on progress regarding food composition dataset, and FFQ</li> </ul>	TUM, national partners national partners in Benin and Kenya	<b>X</b>
<b>2: Soliciting innovations generated by farmers and other actors in the value chains</b>					
		Organizing farmer innovation contests in three pilot countries incl. training of FARA and national partners	Innovation contests in Kenya, Zambia and Malawi	ZEF, FARA, national partners	
		Launching farmer innovation contests in the remaining countries (finalizing in 2017)	Innovations contests in the remaining PARI countries	FARA, national partners, ZEF	<b>X</b>
<b>3: Scaling of innovations</b>					
		Guiding and facilitating scaling-up of innovations across countries		FARA	<b>X</b>
		Countries collaborative research		FARA, national partners	<b>X</b>
		Supporting dairy value chains through innovations in feeding, milk cooling and institutional development in Kenya, with additional activities in Tunisia	<ul style="list-style-type: none"> <li>• Prototypes of improved insulated milk cans, cleaning system and control units for solar freezers</li> <li>• Net-Maps of selected dairy value chains and stakeholder analysis</li> </ul>	UHOH, national partners in Kenya (and Tunisia)	<b>X</b>

	Supporting mechanization of crop production of smallholder farms with focus on gender and capacity development in Zambia, with additional activities in Ghana	<ul style="list-style-type: none"> <li>• Development of Smartphone App</li> <li>• Comparative historical study and policy note</li> <li>• Final report with recommendations</li> </ul>	UHOH, national partners in Zambia (and Ghana)	<b>X</b>
<b>WP III: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security</b>				
	Annual Research and Planning Meeting of PARI	Draft workplan for 2017	ZEF & all partners	<b>X</b>
	Policy consultations on agric. innovation in Africa (CAADP): Side-event during the Science Week & FARA's General Assembly in Kigali		FARA, ZEF & all partners	
	Networking activities for coherence		FARA, ZEF & all partners	<b>X</b>
	Country level interaction to verify and validate research questions and analytical approaches		AGRODEP, FARA, ZEF & all partners	<b>X</b>
	Team meeting		All partners	<b>X</b>
	Other meetings		Various partners	<b>X</b>
	PARI Website		ZEF	<b>X</b>

## 6. Collaboration

### 6.1. Collaboration within the PARI consortium

PARI has established a far-reaching network of partners in Africa, India and Germany. In terms of people (with typically 3 partners in each country, partners at sub-regional and Africa-wide organizations, and the 3 partner Universities in Germany as well as other German collaborators), this adds up to a community of about 70 researchers and practitioners, that engage in PARI. Many of these are not financially supported by PARI, but are actively supporting PARI activities with advice and their organizations' infrastructures and information and data sources, as they are part of the PARI partners' long-standing networks. This network managed by PARI provides a strong basis to facilitate impact through cooperation and dissemination across countries.

There is an intensive exchange and collaboration between the consortium partners of PARI as the following examples show:

- The team leaders of PARI's consortium have an exchange on a regular basis. Especially important are the regular planning and coordination consultations among Prof. Joachim von Braun (ZEF) with Dr. Ousmane Badiane (AGRODEP) and Dr. Yemi Akinbamijo (FARA).
- AGRODEP's team is collaborating with the crop modelling specialists from the University of Bonn and ZEF to explore potential synergies and complementarities between IFPRI's economic models and data repositories and ZEF's crop models. More precisely, the following meetings were held in 2015:
  - June 1-2, 2015: Dakar, Senegal, IFPRI's West and Central Africa Office (WCAO): Meeting between technical teams working on the e-Atlas and the economic modelling component of the project.
  - October 2nd 2015: Bonn, Germany, ZEF office: Workshop between the economic modelling team, the crop modelers, and the ZEF research coordination team.
  - November 2015: PARI Annual Research and Planning Meeting held at Bonn, Germany, ZEF office: Modelling Workshop between the economic modelling team, the crop modelers, and the ZEF researchers.
- FARA is orchestrating the activities of its national partners in the 12 countries and the interaction between the national partners and the consortium partners.
- The High-Level Planning Meeting as well as the Annual Research and Planning Meeting were fostering the interaction between the national partners in the 12 African countries and the members of the three German universities and AGRODEP. Based on these interactions, the German universities will cooperate closely with several of the African partners in their research planned for 2016 and 2017.

### 6.2. Collaboration with other national and international partners in the frame of PARI's work

The collaboration within the frame of PARI's work with external partners has started during 2015 and will be intensified in the following years. Some examples can be mentioned:

- Abd Salam El Vilaly delivered training sessions in Dakar, Senegal (August 2015) and Nairobi, Kenya (September 2015) for Ministry of Agriculture staff from PARI countries and other countries with eAtlases in development. The sessions demonstrated the eAtlas and provided an overview of data needs of the eAtlas. Ministry staff were trained on procedures for sharing the necessary country data to maintain the eAtlas. Abd Salam El Vilaly also travelled to Tunisia to meet individual with the Ministry of Agriculture and the PARI focal point to discuss data needs for the eAtlas.

- UHOH has arranged research partnerships with additional partners in the following countries:
  - For Zambia, the Indaba Agricultural Policy Research (IAPRI) has been identified as main research partner.
  - For Ghana, the Agricultural Engineering Department of Kwame Nkrumah University of Technology has been identified as research partner.
- UHOH has established a cooperation with the Deere & Company as a private sector partner for the research on mechanization (in 2016). JohnDeere has provided co-funding for research on business models for smallholder mechanization in Zambia. Options to obtain funding from the JohnDeere Foundation (a charity not linked to JohnDeere's business interests) are currently being explored. The team plans to explore further opportunities to work with private sector organizations, who are interested to work in Africa, such as BAYWA.

### **6.3. Collaboration with the Green Innovation Centers and their partners**

There is a regular exchange between ZEF and:

- BMZ,
- the GIC group at GIZ in Bonn,
- other organizations involved in the accompanying research of SEWOH.

The interaction between PARI and the GIC in the countries has started in 2015 through visits at the GIC, FARA's national partners and other relevant research organizations in:

- Ghana (Prof. Birner and Prof. Köller / UHOH, Dr. Tambo / ZEF);
- Kenya (Dr. Kirui / ZEF).

This interaction will be intensified in the course of 2016 and 2017.

Furthermore, the agricultural engineering group of UHOH has a cooperation with the Green Innovation Center in Tunisia due to an ongoing project on solar-powered milk cooling.

Meetings and collaboration with the Green Innovation Centers in Zambia and Kenya are planned for 2016.

## 7. Information relevant to the project, publication lists and workshop/travel/other activities

### 7.1. List of Publications generated under the PARI project in the reporting period

Ousmane Badiane and Sunday Odjo, Regional trade and volatility in staple food markets in Africa, ZEF-Discussion Papers on Development Policy No. 200, Center for Development Research, Bonn, June 2015, pp. 36.

[http://www.zef.de/uploads/tx\\_zefportal/Publications/zef\\_dp\\_200.pdf](http://www.zef.de/uploads/tx_zefportal/Publications/zef_dp_200.pdf)

ZEF Working Papers 144: Husmann, C., von Braun, J., Badiane, O., Akinbamijo, Y., Abiodun, F.O. and D. Virchow. 2015. Tapping Potentials of Innovation for Food Security and Sustainable Agricultural Growth: An Africa-Wide Perspective.

[http://www.zef.de/uploads/tx\\_zefportal/Publications/zef\\_wp\\_144.pdf](http://www.zef.de/uploads/tx_zefportal/Publications/zef_wp_144.pdf)

### 7.2. List of recent publications from PARI members of relevance for the PARI project

Asseng, S., F. Ewert, P. Martre, R.P. Rotter, D.B. Lobell, D. Cammarano, B.A. Kimball, M.J. Ottman, G.W. Wall, J.W. White, M.P. Reynolds, P.D. Alderman, P.V.V. Prasad, P.K. Aggarwal, J. Anothai, B. Basso, C. Biernath, A.J. Challinor, G. De Sanctis, J. Doltra, E. Fereres, M. Garcia-Vila, S. Gayler, G. Hoogenboom, L.A. Hunt, R.C. Izaurralde, M. Jabloun, C.D. Jones, K.C. Kersebaum, A.K. Koehler, C. Muller, S. Naresh Kumar, C. Nendel, G. O'Leary, J.E. Olesen, T. Palosuo, E. Priesack, E. Eyshi Rezaei, A.C. Ruane, M.A. Semenov, I. Shcherbak, C. Stockle, P. Stratonovitch, T. Streck, I. Supit, F. Tao, P.J. Thorburn, K. Waha, E. Wang, D. Wallach, J. Wolf, Z. Zhao, Y. Zhu, 2015. Rising temperatures reduce global wheat production. *Nature Climate Change* 5, 143-147. DOI:10.1038/nclimate2470.

Bouet, A.; D. Laborde, and L. Deason, 2014: Global Trade Patterns, Competitiveness, and Growth Outlook. Chapter 2 in *Promoting Agricultural Trade to Enhance Resilience in Africa*, ReSAKSS Annual Trends and Outlook Report 2013, Washington DC, IFPRI.

Daum, Thomas (2015). Focus Sustainable mechanisation – a hard row to hoe. *Rural 21*, Vol. 2, p. 20–22.

[http://www.rural21.com/uploads/media/rural2015\\_02-S20-22.pdf](http://www.rural21.com/uploads/media/rural2015_02-S20-22.pdf)

Eyshi Rezaei, E., T. Gaiser, S. Siebert, F. Ewert, 2015. Adaptation of crop production to climate change by crop substitution. *Mitigation and Adaptation Strategies for Global Change* 20, 1155-1174. DOI:10.1007/s11027-013-9528-1.

Eyshi Rezaei, E., H. Webber, T. Gaiser, J. Naab, F. Ewert, 2015. Heat stress in cereals: mechanisms and modeling. *European Journal of Agronomy* 64, 98-113. DOI:10.1016/j.eja.2014.10.003.

Gatzweiler, Franz, Joachim von Braun (ed.) 2016. Technological and Institutional Innovations for Marginalized Smallholders in Agricultural Development. Springer. <http://link.springer.com/book/10.1007%2F978-3-319-25718-1>

Kalkuhl, M., J. von Braun, M. Torero. 2016. Food Price Volatility and Its Implications for Food Security and Policy. Springer Netherlands. <http://link.springer.com/book/10.1007%2F978-3-319-28201-5>

Nkonya, E., A. Mirzabaev, J. von Braun (ed.) 2016. Economics of land degradation and sustainable land management. Springer. <http://link.springer.com/book/10.1007/978-3-319-19168-3>

Zhao, G., S. Siebert, A. Enders, E. Eyshi Rezaei, C. Yan, F. Ewert, 2015. Demand for multi-scale weather data for regional crop modeling. *Agricultural and Forest Meteorology* 200, 156-171. DOI:10.1016/j.agrformet.2014.09.026.



# The PARI Network

Program of Accompanying  
Research for Agricultural Innovation

## The PARI Consortium



UNIVERSITY OF HOHENHEIM



## National Research Organizations in Africa



Institut National des  
Recherches Agricoles  
du Bénin (INRAB),  
Benin



Institut de  
l'Environnement et des  
Recherches Agricoles  
(INERA), Burkina Faso



Institut de Recherche  
Agricole pour le  
Développement  
(IRAD), Cameroon



Bahir Dar University,  
Ethiopia



Council for Scientific  
and Industrial Research  
(CSIR), Ghana



Kenya Agricultural and  
Livestock Research  
Organization (KALRO),  
Kenya



Department of  
Agricultural Research  
Services (DARS),  
Malawi



Institut d'Economie  
Rurale du Mali (IER),  
Mali



Agricultural Research  
Council of Nigeria  
(ARCN), Nigeria



Institute Togolaise  
de Recherche  
Agronomique (ITRA),  
Togo



L'Observatoire  
National de  
l'Agriculture  
(ONAGRI), Tunisia



Researching Soils, Crops and  
Water in Zambia

Zambia Agriculture  
Research Institute  
(ZARI), Zambia

## Other Partners

---



Institute of Crop Science and  
Resource Conservation,  
University Bonn, Germany



Natural Resources  
Institute Finland, Finland