

PARI Interim Report 2016

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in cooperation with PARI Partners



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Zusammenfassung

Die *Begleitforschung für landwirtschaftliche Innovationen* (PARI) vereint Partner aus Afrika, Indien und Deutschland, um gemeinsam zu nachhaltigem landwirtschaftlichen Wachstum und Ernährungssicherheit in Afrika und Indien im Rahmen der deutschen Initiative „Grüne Innovationzentren in der Agrar- und Ernährungswirtschaft“ (GIAE) beizutragen. In 2015 konnten die folgenden Aktivitäten maßgeblich zur Umsetzung von PARIs Zielen beitragen:

1. Innovationsforschung mit zukunftsorientierter Wirkungsanalyse

- a) *Modellierung und Kartierung der direkten und indirekten Wirkungen von erfolgversprechenden Innovationen:* Die Pflanzenwachstums- und wirtschaftlichen Modelle wurden zur Evaluierung von Innovationen im Maisanbau in Ghana und Nigeria angewandt.
- b) *Methoden- und Konzeptentwicklung zur strategischen Potenzialanalyse und Prognose:* Die GIS-basierte Plattform **eAtlas** ist online gegangen. Außerdem wurden für sieben PARI Länder Karten entwickelt, die **ländliche Typologien** abbilden, um Investitionsmöglichkeiten und –lücken mit Bezug auf landwirtschaftliche Innovationen hervorzuheben.
- c) *Institutionelle Analyse der Innovationszentren im Rahmen nationaler landwirtschaftlicher Forschungssysteme:* Die afrikanischen Partner haben jeweils drei **nationale Innovationsstudien** fertiggestellt, die Informationen über landwirtschaftliche Innovationen, existierende Innovationsplattformen und relevante Investitionen zusammentragen. Zusätzlich führten alle PARI Partner länderspezifische und übergreifende thematische Forschung durch, u.a. über Mechanisierung, Innovationsplattformen, Saatgut, berufliche Bildung, Ernährung und Klimawandel.

2. Stimulierung und Identifizierung von technologischen und institutionellen Innovationen

- a) *„top-down“ Innovationsernte aus dem Forschungs- und Innovationssystem:* Die PARI **Innovationsdatenbank** ist online gegangen und bietet Zugang zu technischen und institutionellen landwirtschaftlichen Innovationen.
- b) *„bottom-up“ Innovationsernte von Bauern und anderen Akteuren aus dem Agrar- und Ernährungssektor:* **Innovationswettbewerbe für Bauern** fanden in Äthiopien, Kenia, Malawi und Sambia statt.
- c) *Verbreitung von Innovationen:* Forschung in diesem Themenbereich beschäftigte sich u.a. mit der Rolle des Privatsektors und die Nutzung von Mobiltechnologien in der Verbreitung von Innovationen, Innovationen in der Milchwirtschaft in Tunesien und Kenia, und Erfahrungsaustausch mit Indien.

3. Politik-Dialog zur Förderung von Innovationsansätzen zur Verbesserung der Ernährungssicherheit

Koordinierung und Teilnahme von PARI Konsortiumsmitgliedern an einer Reihe von Veranstaltungen mit dem Ziel, wichtige Interessensvertreter einzubinden und Forschungsaktivitäten zu präsentieren. Outreach Aktivitäten wurden auch durch IKT Anwendungen und Publikationen unterstützt.

Um die **Verknüpfung mit den GIAEs** weiter auszubauen, besuchten die FARA und ZEF Teams gemeinsam die afrikanischen PARI Länder, um die nationalen PARI Partner mit den GIAE zu vernetzen. Des Weiteren tragen die Forschungsaktivitäten zur Arbeit der Zentren bei, z.B. die Identifizierung von Innovationen durch die Datenbank, die Wettbewerbe und die Modellierung; die Analysen des nationalen Innovationsumfelds; und PARIs Bemühungen, nationale und regional Politik zu beeinflussen.

Executive 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. In 2016, 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:* The crop and economic modelling teams finalized adaptations of their respective models and applied them to the assessment of crop-related innovations for maize in Ghana and Nigeria.
- b) *Developing methodologies and concepts for strategic analysis of potentials and prospects:* The GIS-based mapping tool **eAtlas** was launched and training workshops were held in several African countries. In addition, maps displaying **rural typologies** to identify investment opportunities and gaps for agricultural innovation were completed for seven African PARI countries.
- c) *Institutional analysis of the GICs in the context of their national agricultural innovation systems:* The African national partners finalized three **national innovation studies** which provide baseline information on the state of agricultural innovations, existing Innovation Platforms and innovation investments in the respective country. In addition, country-specific and cross-cutting **thematic research** was carried out by all PARI partners. Focus areas include, among others, mechanization, innovation platforms, seeds and seed systems, vocational training, nutrition and climate change.

2. Identifying and stimulating technological and institutional innovations

- a) *Screening for promising innovations from research and innovation systems:* The PARI **Agricultural Innovation Database** was launched to share promising 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 **innovation contests** took place in Ethiopia, Kenya, Malawi and Zambia.
- c) *Scaling innovations:* Research in this area focused, among other topics, on the role of the private sector in scaling of innovations, the use of mobile technologies in disseminating information on innovations and facilitating social learning, scaling innovations in the dairy sectors of Tunisia and Kenya, and learning from the Indian experience on scaling grassroots innovations.

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. Outreach activities were supported by several ICT tools and publications.

To strengthen **linkages with the GICs**, the FARA and ZEF teams conducted joint visits to the African PARI countries to link the national partners and the GICs. Input into the work of the GICs is also provided through the innovations identified, evaluated and made accessible by PARI, e.g. through the database, the contests and the modeling; research into the national innovation environment and investment potentials; and PARI's efforts to shape domestic and regional innovation policies.

1 Project overview

1.1 Objective of the Program of Accompanying Research for Innovation – PARI

PARI brings together partners from Africa, India and Germany **to contribute to sustainable agricultural growth and food and nutrition security in Africa and India**. PARI offers independent scientific advice to the German government's "One World, No Hunger" Initiative (SEWOH). Among other activities, SEWOH seeks to achieve its objectives by establishing Green Innovation Centres (GICs) in 12 African countries (Benin, Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Mali, Malawi, Nigeria, Togo, Tunisia, Zambia) and India.

The research-based information generated in PARI 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. 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. Specifically, the Program aims at:

1. promoting and supporting the scaling of proven innovations in the agri-food sector in collaboration and partnership with all relevant actors;
2. supporting and enhancing investments in GICs through research; and thereby
3. contributing to the development of the agri-food sector in Africa and India through the identification, assessment and up-scaling of innovations.

To achieve these objectives, PARI's collaborative work is divided into three main fields of accompanying research (work packages):

WP 1: Innovation research with future-oriented impact analyses, incl.:

- Activity I/1: modeling and mapping direct and indirect impacts of potentially promising innovations
- Activity I/2: developing methodologies and concepts for strategic analysis of potentials and prospects
- Activity I/3: institutional analysis of the GICs in the context of their national agricultural innovation systems

WP2: Identifying and stimulating technological and institutional innovations, incl.:

- Activity II/1: screening for promising innovations from research and innovation systems ("research proven top-down approach"),
- Activity II/2: soliciting innovations generated by farmers and other actors in the value chains ("farmer participation bottom-up approach"),
- Activity II/3: scaling of innovations.

WP3: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security

1.2 Core partners

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

The national partners in Africa and India include:

- National Agricultural Research Institute of Benin (INRAB)
- Institut de L ' Environnement et de Recherches Agricoles (INERA), Burkina Faso
- Institut de Recherche Agricole pour le Developement (IRAD), Cameroon
- Ethiopian Development Research Institute (EDRI)
- Council for Scientific and Industrial Research (CSIR), Ghana
- Kenya Agricultural and Livestock Research Organization (KALRO)
- Department of Agricultural Research Services (DARS), Malawi
- Institut d' Economie Rurale (IER), Mali
- Agricultural Research Council of Nigeria (ARCN), Nigeria
- Institut Togolaise de Recherche Agronomique (ITRA)
- Institut National de Recherche Agronomique de Tunis (INRAT)
- Zambia Agriculture Research Institute (ZARI)
- Indian Council for Research on International Economic Relations (ICRIER)

2 Activities and achievements in 2016

WP 1: Innovation research with future-oriented impact analyses

PARI is evaluating contributions of innovations to sustainable agricultural growth and food and nutrition security, high potential areas for investments and the necessary framework condition to develop and scale promising innovations.

Activity I/1: Modeling and mapping direct and indirect impacts of potentially promising innovations

The modelling research in PARI assesses the impact of different crop-related technology packages on yields and economic performance in selected African countries. In 2016, the research focused on innovations for maize in the different agro-ecological zones of Ghana and Nigeria. The technologies tested included different nitrogen application rates, sowing dates and cultivars (and combinations thereof).

To this end, the **crop modelling** team at ZEF and INRES (Institute of Crop Science and Resource Conservation, University of Bonn) developed and applied a crop model to assess the impact of selected innovation scenarios on maize yield in Ghana and Nigeria. The outcome of the crop modeling activities showed that the combination of agronomic innovations including dose and timing of nitrogen application, sowing date, new cultivars and deficit irrigation on maize cropping systems could improve the range of maize yield from 1.0-1.5 t ha⁻¹ to 2.5-5.0 t ha⁻¹ over the study period and countries. However, the magnitude of change in yield was country and year specific. The outputs of the crop modelling served as an input into the economic modelling at AGRODEP/IFPRI.

In parallel, the **economic modelling** team designed an analytical framework to implement the innovation scenarios. The team modified the MIRAGRODEP Computable General Equilibrium (CGE) model and developed specific templates for the new data requirements and the scenario inputs. The model was also transformed to work at the subnational level (using agro-ecological zones and homogenous production units) so that it can be linked to the eAtlases and Rural Typologies (see below).

In **2017**, the crop and economic modelling will be completed for Ghana and Nigeria (maize). Additional countries to be covered in 2017 include Kenya (maize and wheat), Ethiopia (maize and wheat), Malawi (maize) and Burkina Faso (maize).

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

Mapping agricultural, socio-economic and bio-physical indicators for policy-making

2016 saw the launch of the **country eAtlases**, a GIS-based mapping tool designed to help policy analysts and policymakers access and use high quality and highly disaggregated data on agricultural, socio-economic and bio-physical indicators to guide agricultural policy and investment decisions (Figure 1). Specifically, the eAtlases:

- (i) provide an online, highly interactive and dynamic data environment rich with standard pre-processing and essential data analysis tools,
- (ii) assemble in one resource data from a variety of domains necessary for effective policy design and targeting, and
- (iii) ensure broad access to high quality data to facilitate inclusive review and dialogue processes.

Figure 1: Screenshot of eAtlases



The target audience of the eAtlases include (i) government ministries and agencies, (ii) academic institutions, research institutions and policy analysts, (iii) civil society organizations and farmer organizations, and (iv) agribusiness and other private sector firms.

In 2016 the eAtlases technical team designed a server infrastructure for the online manipulation of data records with a focus on routine preprocessing functions such as data filtering, time series and anomaly generation, reformatting, subsetting, and bundling. The team also developed an intuitive and rich web-based client application for the 12 countries covered by the PARI project in Africa to support interaction with the data records as well as a set of data preprocessing best practices and tools (Table 1). In order to promote the use of geospatial data and tools in the PARI countries, the eAtlases technical team organized workshops in Benin, Burkina-Faso, Ghana, Mali, Malawi and Togo to validate the eAtlas data and transfer the eAtlas and related tools to the countries.

Table 1: Deployment and validation of the PARI country eAtlases in 2016

Objectives	Outcomes	Deliverable
<p>Improve the capacity of PARI countries and their network partners in their efforts to use remote sensing and geographic information systems in support of data collection, monitoring and evaluation, analysis, and diffusion by</p> <ul style="list-style-type: none"> - Introducing the eAtlas platform and its associated tools in each country, - Training 6-8 primary GIS and remote sensing specialists in each country to maintain the country eAtlas. 	<p>The workshop contributed to the establishment and strengthening of PARI countries and their networks in the use of remote sensing and GIS tools.</p> <p>The workshop offered a space in which diverse groups of actors can (1) gain access to the country eAtlas, (2) communicate their concerns about the use of the eAtlases, and (3) organize themselves to share data for the country eAtlas</p>	<ul style="list-style-type: none"> - Server side infrastructure for the online manipulation of a list of socioeconomic, basic biophysical and climate data with focus on routine preprocessing, - Intuitive and rich web-based client application to support interacting with these data records - A set of data preprocessing best practices and tools - Specialized tools and hands-on training on the use of this system

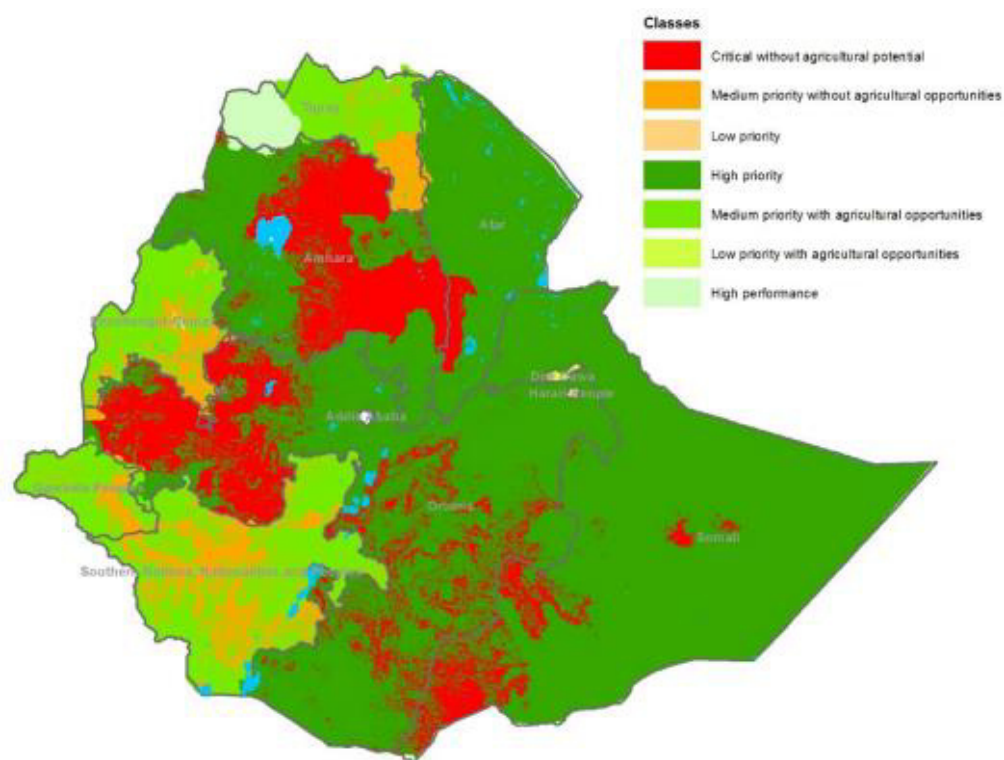
In **2017**, further launch and training activities are planned to publicize the eAtlases and train national stakeholders on their use.

Mapping the agricultural production frontier

PARI is developing a **Rural Typology** of micro-regions in the African PARI countries to identify micro-regional level opportunities, bottlenecks and investment gaps for agricultural innovation. The stochastic frontier approach applied in this research allows us to predict smallholders' agricultural revenue potential and efficiency measures at the regional level. These predictions are then used to estimate where the agricultural revenue frontier lies and how far each producer is from it. Using regional poverty measures to establish targeting priorities, the potential and efficiency estimates help to assess whether local agricultural innovations should be focused on pushing the frontier boundaries or on reducing existing inefficiencies that prevent smallholders from reaching it. The results are grouped into classes depending on the type of opportunities for innovation to enhance agricultural production and reduce rural poverty which are then displayed in typology maps (see Map 1 for the example of Ethiopia).

In 2016, the team at AGRODEP/IPPRI completed preliminary versions of the typology for five more countries, bringing the current total to seven completed typologies. Typologies have been completed for Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Nigeria and Zambia. The typologies for the remaining African PARI countries will be completed in **2017**.

Map 1: Typology map of Ethiopia



Source: Maruyama et al. (2017)

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

Assessing opportunities and constraints in national innovation environments

Work on the **national innovation studies** conducted by the national partners in each African partner country was completed in 2016. The studies offer in-depth insights into the status of agricultural innovations, agricultural investments and innovation platforms in the respective countries.

The studies show that many promising agricultural innovations are available at the national level. However, much of the focus lies on technological innovations while too little attention is paid to managerial and institutional innovations. Also, most of the available innovations suffer from low adoption rates. The investments to provide the necessary framework conditions to scale innovations are insufficient, given that most countries still fall short of their commitment to invest 10% of public expenditures in the agriculture sector. Agricultural innovation platforms, which bring multiple stakeholders together to catalyze and facilitate agricultural innovation, have gone some way towards supporting adoption. The studies also showed, however, that many are faced by persisting natural (climate, diseases), technical (competence of stakeholders for solving problems), financial (sustainability of funding) and organizational (mutual commitment and investment for the stakeholders for success of platforms) constraints that undermine the functionality and sustainability of the platforms.

The findings of the studies also provided valuable inputs into the revision of the 12 **African country dossiers** which was ongoing in 2016 and will be finalized in 2017. The dossiers describe the state of agriculture innovation in the respective country and value chains and the potentials for German collaboration for agricultural R&D.

Country-level thematic research

The national partners in Africa and India developed and implemented research projects that sought to meet both the PARI objectives and the domestic policy priorities. Drafts were completed in 2016 and will undergo a thorough review process in 2017 before final publication. Overlapping research themes include: innovation platforms, scaling innovations, mechanization and post-harvest technologies, improved varieties, soil & water management, nutrition and climate change. While some research outputs cut across the agriculture sector, others focus on specific value chains, including several GIC value chains.

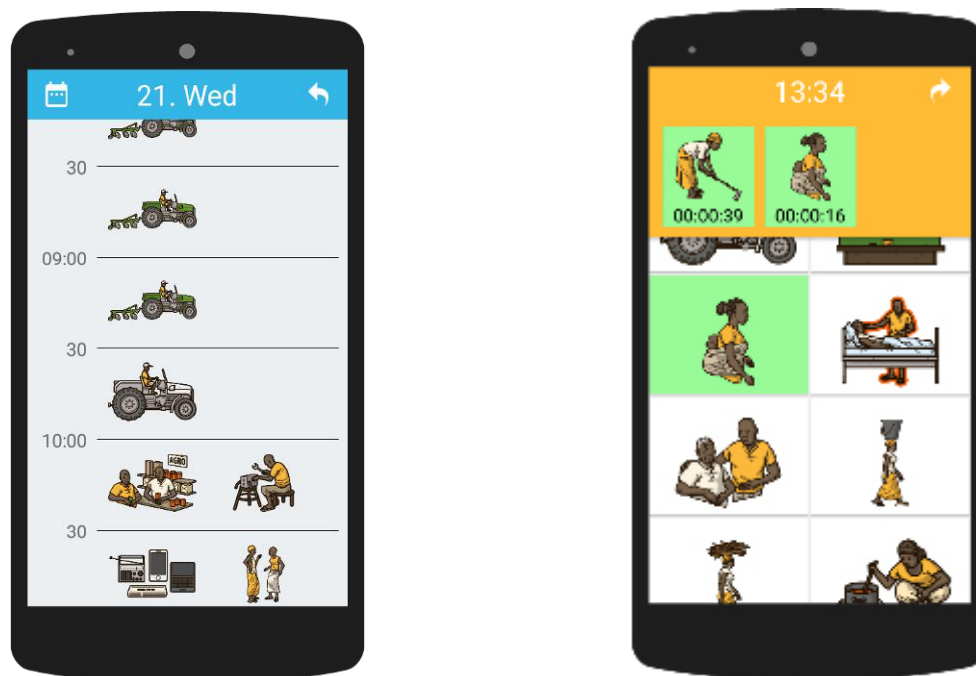
In **2017**, efforts will be made to better integrate country partners' research. To this end, thematic research priorities were jointly identified by all partners at the PARI Annual Research and Planning meeting (December 2016). They include: strategies for scaling innovations, mechanization and skill development, climate change and nutrition. Countries will be encouraged to align their research plans with the agreed themes.

Cross-cutting thematic research

Mechanization: Research led by UHOH evaluates options for institutional reforms to advance mechanization in African agriculture, including a review of historical experiences in Germany, the USA and Ghana, as well as a more in-depth review of related governance challenges in Ghana. The team also conducted research to evaluate the impact of mechanization on intra-household division of labor in

Zambia using the smartphone app Timetracker which enables respondents in household surveys to record daily activities themselves (Figure 2).

Figure 2: Smartphone App TimeTracker



Developed by the University of Hohenheim and the Stuttgart Media University

Vocational Education and Training: An overview study led by ZEF was prepared to explore experiences, opportunities and readiness for VET in the agriculture and food sector in Africa. The study includes a review of the literature related to agricultural VET, an assessment of the state of VET systems in Africa (and particularly the PARI countries), and selected experiences with VET systems outside Africa (with emphasis on Germany and India).

Nutrition: Research led by TUM addresses two dimensions of nutrition security in African smallholder agriculture. First, draft studies were completed that analyze the relationship between farm diversification and dietary diversity of farm households in Tanzania, Ethiopia and Nigeria. The second research project explores the feasibility of offering personalized nutrition advice through a Smartphone App, based on an analysis of anthropometrics, frequency and amount of the food intake of households and personal micronutrient levels (assessed through dried blood spots). In 2016, a 'proof of concept' study got underway in Benin in collaboration with the national PARI partner INRAB.

Gender: A study led by ZEF on the gender dimension of agricultural innovations assesses options for ensuring that women are included as beneficiaries of productivity increases through technological and institutional innovations, and examines how to engender the development, assessment and scaling up of innovations.

Seeds systems: A study led by the German Institute for Tropical and Subtropical Agriculture got underway in 2016 which identifies seed system interventions and developments that can contribute to sustainable benefits for the full range of farmers and address the opportunities and needs for crops vital for food security and income in Sub-Saharan Africa. The study focuses on seed systems in Kenya (maize and sorghum) and Mali (maize, sorghum, pearl millet and rice)

Employment: A study led by the Cheick Anta Diop University of Dakar, Senegal, examines opportunities for generating employment and increasing income in agricultural value chains and thereby fostering food security in the rice and cotton value chains in Benin and Senegal.

WP2: Identifying and stimulating technological and institutional innovations

This component of PARI identifies promising innovations for the agricultural and food sector along value chains and markets in the respective national and regional context of the GICs, and assesses strategies for scaling these innovations.

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

In 2016, the **PARI Agricultural Innovation Database** was launched. The online database includes technological, managerial and institutional innovations that could be applied along agricultural value chains. The aim of the database is to identify and document the most promising innovations in agriculture and the food sector that have the potential to be scaled up in tropical and sub-tropical countries in general and especially across the countries linked to PARI in Africa and India. In **2017**, the national partners in Africa and India will add the most promising agricultural innovations from their research systems to the database.

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

In 2016, **farmer innovation contests** were held in Malawi, Kenya, Zambia and Ethiopia. The contests are aimed at identifying and stimulating high-potential farmer innovations which lend themselves to easy adaptation and dissemination. The key partners in the countries include the Ethiopian Development Research Institute, the Kenya Agricultural and Livestock Research Organization, Malawi’s Department of Agricultural and Research Services and the Zambia Agricultural Research Institute. In each country, the contests are being implemented in three counties/districts in the GICs’ project areas. In **2017**, additional contests will be held in Cameroon and Mali under the leadership of FARA.

Activity II/3: Scaling of innovations.

Fostering Africa-India learning on scaling innovations

In 2016, a collaborative research project was launched with the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI) in India which will review India’s experience with screening and scaling grassroots innovations in India in order to identify lessons for Africa. The study will be finalized in 2017.

Scaling innovations in the dairy sector

Research led by the University of Hohenheim examines promising and potentially scalable innovations to increase productivity in the dairy sectors of Kenya and Tunisia. The points of intervention identified in the dairy value chain include improved cattle feed and cost-effective milk cooling systems for smallholder farmers. In 2016, feeding trials got underway to identify the most suitable feed composition. In 2017, the findings will be used to develop a mobile phone-based diet formulation tool for dairy farmers in the tropics. In addition, the solar-powered milk cooling system already tested in Tunisia in 2015 was further improved and deployed in Kenya. In 2017 options for commercializing the milk cooling system will be explored in the two countries.

Additional ongoing research activities under this Activity include:

- Various studies undertaken by the national partners to identify opportunities for scaling innovations in specific **value chains** of interest to the respective country's economy and the GICs.
- A study on the role of **private sector** investments in improving access to and scaling of innovations (led by ZEF).
- A study on the role of **mobile technologies** and in particular social media to disseminate information on innovations and facilitate social learning among network participants (led by ZEF).

WP3: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security

Two PARI **policy briefs** were published in 2016:

- PARI Policy Brief No. 1: Strategic Directions for Development Collaboration for Food Security and Agricultural Growth in Sub-Saharan Africa
- PARI Policy Brief No. 2: Farmer Innovation Contests – Tapping the Innovative Potential of Smallholder Farmers

Additional policy briefs are planned for **2017** to summarize the key findings and policy messages emerging out of the various research activities.

During 2016, PARI organized or participated in several **policy-relevant meetings and conferences** in Germany, Africa and India to share research insights and policy recommendations and network with SEWOH partners. The most important ones include:

- Presentations at the 'International Green Week', Berlin, 16-18 January
- PARI Side-event and presentations at the 7th Africa Agricultural Science Week, Kigali, 13-16 June
- Annual GIC/GIZ network meeting, Feldafing, 11-12 July
- Presentations at the African Green Revolution Forum, Nairobi, 5-9 September
- PARI Side-event and presentations at the 5th African Association of Agricultural Economists (5th AAAE), Addis Ababa, 23-26 September
- Meeting of the SEWOH Accompanying Research partners, Hamburg, 27 September
- PARI Annual Research and Planning Meeting, Nairobi, 8-9 December
- Participation in the Strategic Advisory Committee of the SEWOH

The PARI team was also actively engaged in the preparatory process of the BMZ “ONE WORLD – No Hunger. Future of the rural world”. The PARI Director Joachim von Braun co-chaired the advisory committee responsible for drafting the Berlin Charter that was adopted at the conference in April 2017.

The various **ICT tools** supported by PARI are also used to disseminate PARI research findings and reach out to policy makers, notably the PARI Website, the PARI Agricultural Innovation Database and Country eAtlases mentioned above, as well as the FARA-led Innovation Platform Agribusiness Portal (IPAbP) which aims at aggregating information about all agricultural innovation platforms in Africa to foster linkages with other agricultural innovation organizations, donors and development partners.

In **2017** PARI partners will continue and expand their efforts to disseminate research findings in policy making processes through side-events and presentations at meetings, strategic advice, publications and online tools. In addition, two multi-stakeholder **policy roundtables** will be held in Africa to present nationally relevant research outputs. The roundtables will serve to ground-truth the research findings, create buy-in for the research process and outputs and feed the research insights into domestic policy processes.

3 Summary of PARI activities in 2016 and outlook for 2017

Table 2 summarizes the PARI activities undertaken in 2016, their status by the end of the reporting period, an outlook for 2017 and the lead partner. **Map 2** broadly summarizes the country-specific research carried out by the various partners in 2016.

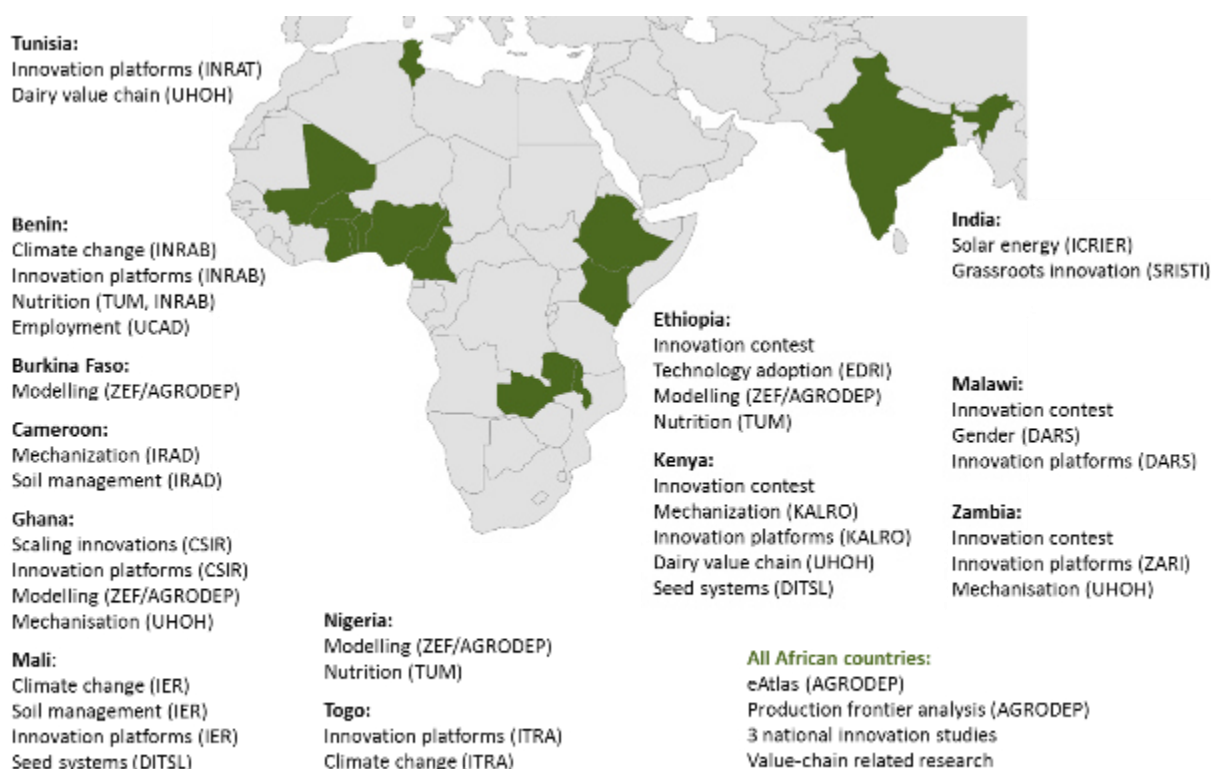
Table 2: Summary of PARI activities by Work Packages

Deliverable	Status by end-2016	Outlook for 2017	Lead organization(s)
Work package I: Innovation research with future-oriented impact analyses			
Activity I/1: Modelling and mapping direct and indirect impacts of potential promising innovations			
Modelling of the impacts of agricultural innovations on yield and economic performance	Crop modelling completed for maize in Ghana and Nigeria. Economic modelling completed for Ghana.	Ethiopia, Ghana, Kenya, Malawi, Nigeria and Burkina Faso	ZEF, INRES, AGRODEP/IFPRI
Training and backstopping of AGRODEP members	Training completed in 6 countries	To be continued	AGRODEP/IFPRI
Activity I/2: Developing methodologies and concepts for strategic analysis of potentials and prospects			
eAtlas platform	Online	Additional launch and training events planned	AGRODEP/IFPRI
Production frontier analysis	Completed in 7 countries	To be completed for all African PARI countries	AGRODEP/IFPRI
Activity I/3: Institutional analysis of the GICs in the context of their national agricultural innovation systems			
National innovations studies on the status of agricultural innovations, investments and innovation platforms	Completed and available online, draft synthesis studies prepared	Synthesis studies to be completed	FARA, national partners

Update of African Country Dossiers	Ongoing	To be completed	ZEF, FARA, national partners
Thematic research at country level	Draft studies completed	Drafts to be reviewed and published, further research planned	National partners
Study on the status of agricultural vocational education and training in Africa and globally	Draft study completed	Draft to be reviewed and published, Study on reform options for AVET in 2-3 PARI countries	ZEF
Study on the gender dimension of agricultural innovations	Draft study completed	To be reviewed and published	ZEF
Studies on the role of farm diversification for dietary diversity of farm households	Draft studies completed for Ethiopia, Tanzania and Nigeria	Drafts to be reviewed and published, study on agr. innovation and climate variability, study on food consumption in urban and rural areas	TUM
Study on the personalized nutrition advice in Benin	First survey round completed	Additional survey rounds and DBS analysis to be completed and analyzed, study on concept of personalized nutrition in Africa	TUM, INRAB
Studies on governance options for mechanization	Ongoing (comparative historical study, governance challenges in Ghana)	To be completed	UHOH
Study on the impact of mechanization on the intra-household division of labor	Ongoing	To be completed	UHOH
Study on employment generation in agricultural value chains in Benin and Senegal	Ongoing	To be completed	UCAD
Work package II: Identifying and stimulating technological and institutional innovations			
Activity II/1: Screening for promising innovations from research and innovation systems			
PARI Agricultural Innovation Database	Online database launched, innovations from the German university partners added	Input from the African PARI partners and India	ZEF (online platform), all partners (input)
Activity II/2: Soliciting innovations generated by farmers and other actors in the value chains			
Farmer innovation contests	Largely completed in Kenya, Ethiopia, Malawi and Zambia	Awards to be handed out, additional contests in Mali and Cameroon, study on farmers' perception on intellectual property rights	FARA, national partners, ZEF

Activity II/3: Scaling of innovations			
Value chain-related research at country level	Draft studies completed	Drafts to be reviewed and published, further research planned	National partners
Study on the applicability of the Indian approach to identifying and scaling grassroots innovations in Africa	Ongoing	To be completed	SRISTI
Development and evaluation of a solar-based milk cooling system in Tunisia and Kenya	New insulated milk can developed in Tunisia; milk cooling system introduced in Kenya	Study on improving milk value chains through solar milk cooling	UHOH, national partners
Study on improving dairy cattle nutrition in smallholder production systems in Tunisia and Kenya	Feeding trials underway	Study on options for feeding African cattle, Diet Formulation App	UHOH, national partners
Study on the role of private sector investments in the African food and agricultural sector	Draft study completed	To be reviewed and published	ZEF
Study on the use of ICTs to enhance productivity in the agri-food sector	Ongoing	Study on use of social media in smallholder agriculture	ZEF
Work package III: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security			
Formal and informal input into policy debates	Attendance at various meetings and in strategic advisory bodies of SEWOH, informal engagement with policy makers	To be continued, 2 national policy roundtables to be held (Ghana, tbc)	All partners
PARI policy briefs	2 briefs completed	Additional briefs planned	All partners
PARI website	Online	To be expanded	ZEF (online platform), all partners (contributions)
Innovation Platform Agribusiness Portal (IPAbP)	Online	To be expanded	FARA

Map 2: PARI research in 2016 by country



Publications

National innovation studies in the 12 African PARI countries.

<http://research4agrinnovation.org/publication/pari-country-studies/>

PARI Policy Brief No. 1: Strategic Directions for Development Collaboration for Food Security and Agricultural Growth in Sub-Saharan Africa (available in English and French).

<http://research4agrinnovation.org/publication/pari-policybrief1/>

PARI Policy Brief No. 2: Farmer Innovation Contests – Tapping the Innovative Potential of Smallholder Farmers (available in English and French).

<http://research4agrinnovation.org/publication/pari-policybrief2/>

Gulati A, Machanda S and Kacker R (2016) *Harvesting Solar Power in India*, ZEF – Working Paper No. 152, Center for Development Research, Bonn.

<http://research4agrinnovation.org/publication/solar-power-in-india/>

Kiu et al. 2016. Similar estimates of temperature impacts on global wheat yield by three independent methods. *Nature Climate Change* 6, 1130-1136.

Rötter RP et al. (2016) On the use of agricultural system models for exploring technological innovations across scales in Africa: A critical review, ZEF – Discussion Papers on Development Policy No. 23, Center for Development Research, Bonn.

http://research4agrinnovation.org/publication/modelling_review/

Torero M and Maruyama E (2016) Progress report on Agricultural Typologies Work, PARI.

<http://research4agrinnovation.org/publication/progress-report/>

As indicated in the summary table, various studies are also available in draft and will undergo a rigorous review process in 2017.

In addition a number of **ICT tools** have been developed in the context of PARI:

- PARI Agricultural Innovation Database
<http://research4agrinnovation.org/publication/pari-database/>
- Country eAtlases
<http://research4agrinnovation.org/publication/resakss-country-eatlases/>
- Innovation Platform Agribusiness Portal
<http://research4agrinnovation.org/publication/ipabp/>
- Smartphone App TimeTracker
<http://research4agrinnovation.org/publication/timetracker/>
- PARI Website
<http://research4agrinnovation.org>

4 Collaboration with the Green Innovation Centers

Regular exchanges between the PARI and GIC teams in Bonn continued and the team members attended the respective annual meetings in Feldafing and Kenya. In addition, particular efforts were made in 2016 to link the national PARI partners in Africa with the GICs. To this end, the FARA and ZEF teams conducted joint visits to the countries to establish these linkages and raise awareness of the PARI activities. A scoping visit was also undertaken to Mozambique during the preparatory phase of the new GIC in order to establish the linkages early on in the process.

The GICs can also benefit from the innovations identified, evaluated and developed in PARI. Information about potentially relevant innovations is available to GIC staff through the searchable online PARI Innovation Database. In addition, the farmer innovation contests carried out in 2016 all took place in the districts covered by the GICs and involved GIC staff in the implementation. Moreover, the outcomes of the modeling activities in PARI can inform decisions on the deployment of crop-related innovations. PARI also collaborated with the GICs on the introduction of the solar-powered milk cooler by the University of Hohenheim in Kenya.

In addition, PARI research aims at strengthening and helping to scale the activities of the GICs. The national-level innovation studies and Rural Typology carried out in 2016 serve as an input for GIC staff to better understand and more effectively operate in the national innovation environment. In addition, PARI's efforts to shape domestic and regional policies will support innovation development and scaling, including in the GICs.

Impressions from the PARI Activities



Jane Chirambo, one of the contest winners from Malawi, presenting her Nyachirambo livestock booster



Testing the Smartphone App Timetracker with survey participants in Zambia (Photo: Hannes Buchwald)



Visit to the Green Innovation Centre in Kenya (Photo: Oliver Kurui)



Engaging with African policy-makers at the African Green Revolution Forum 2016 in Nairobi



Participants at the PARI Annual Research and Planning Meeting 2016, 8-9 December



Prof. Ashok Gulati presents India's experience on agricultural innovation at the PARI Annual Meeting



Introduction to the eAtlas during the "Marketplace of Ideas" at the PARI Annual Meeting