

PARI Interim Report 2018

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in cooperation with PARI Partners



Table of Contents

Zusammenfassung	2
Executive Summary.....	4
1 Project overview	6
<i>Objective of the Program of Accompanying Research for Innovation – PARI.....</i>	<i>6</i>
<i>Core partners</i>	<i>7</i>
2 Activities and achievements in 2018.....	8
<i>WP 1: PARI Innovation research with future-oriented impact analyses.....</i>	<i>8</i>
Activity I/1: Modeling and mapping direct and indirect impacts of potentially promising innovations.....	8
Activity I/2: Developing methodologies and concepts for strategic analysis of potentials and prospects.....	8
Activity I/3: Institutional analysis of the GICs in the context of their national agricultural innovation systems	9
<i>WP2: African ICT Platform for Agricultural Innovations: Strengthening the Innovation Potential through Information and Communication Technologies.....</i>	<i>10</i>
<i>WP 3: Vocational training for farmers and other actors in the agri-food value chain</i>	<i>11</i>
<i>WP 4: Research-based identification and stimulation of technological and institutional innovations (plus sub-topics)</i>	<i>12</i>
Activity II/1: Screening for promising innovations from research and innovation systems (“research proven top-down approach”)	12
Activity II/2: Drivers of farmer innovativeness	12
Activity II/3: Scaling of innovations.....	13
<i>WP5: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security.....</i>	<i>16</i>
Policy Briefs.....	16
Policy Events	17
Social Media Outreach.....	19
3 Summary of PARI activities in 2018 and outlook for 2019.....	21
4 Publication List	23

Zusammenfassung

Die *Begleitforschung für landwirtschaftliche Innovationen* (PARI) vereint Partner aus Afrika, Indien und Deutschland, um zu nachhaltigem landwirtschaftlichen Wachstum und Ernährungssicherheit im Rahmen der deutschen Initiative *Eine Welt Ohne Hunger* beizutragen. 2018 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*: Das Modellierungsteam untersucht, wo verschiedene kleinere Bewässerungstechnologien das größte Potenzial bieten, speziell in Niger und Mali sowie ganz Afrika. Zusätzlich ermittelt eine Studie, wo und in welchem Umfang Nachernteverluste in den Wertschöpfungsketten auftreten und welche Kosten diese für die Wirtschaft bedeuten. Die Modellierungsergebnisse ermöglichen es, Investitionen zu priorisieren. Die Studien werden in 2019 abgeschlossen.
- b) *Methoden- und Konzeptentwicklung zur strategischen Potenzialanalyse und Prognose*: PARI Forschung ermittelte, inwieweit Investitionen in den Agrar- und Ernährungssektor in Afrika das gesamtwirtschaftliche Wachstum steigern und damit die Ernährungsunsicherheit verringern. Typologien von Mikroregionen in ausgewählten afrikanischen PARI-Partnerländern zeigen Prioritäten für Infrastrukturinvestitionen auf, z.B. in Senegal und Burkina Faso.
- c) *Institutionelle Analyse der Innovationszentren im Rahmen nationaler landwirtschaftlicher Forschungssysteme*: PARI-Forschung bewertete Möglichkeiten für eine bessere Integration von Frauen in den afrikanischen Agrar- und Nahrungsmittelsektor. Zudem identifizierten mehrere Studien Muster und Auswirkungen der Mechanisierung in der afrikanischen Landwirtschaft. Untersuchungen zeigen zum Beispiel, dass Landwirte, die Traktoren zur Bodenbearbeitung einsetzen, ihr Einkommen fast verdoppeln können, indem sie einen deutlich größeren Teil ihres Landes zeitgerecht bewirtschaften. Drittens konzentrierte sich die Forschung auf Ernährung. Eine Studie in Benin untersucht die Auswirkungen einer digitalen Anwendung für individuelle Ernährungsberatung auf die Ernährungsgewohnheiten der Haushaltsmitglieder.

2. Afrikanische IKT-Plattform für landwirtschaftliche Innovationen: Stärkung des Innovationspotenzials durch Informations- und Kommunikationstechnologien (IKT)

Im Rahmen einer laufenden Studie werden die technologische und wirtschaftliche Machbarkeit der Zusammenführung digitaler Dienstleistungen im Lebensmittel- und Agrarsektor auf einer einzigen Online-Plattform untersucht. Darüber hinaus werden in Kenia, Ghana und Nigeria Länderstudien durchgeführt, die den Status und das Potenzial der IKTs im Agrar- und Nahrungsmittelsektor des jeweiligen Landes dokumentieren. In einer Querschnittsstudie soll zudem ermittelt werden, welche Rahmenbedingungen die Entwicklung, Skalierung und Wirkung von IKT-gestützten Diensten in den Bereichen Ernährung und Landwirtschaft fördern können. Diese Studien werden 2019 veröffentlicht.

3. Berufsausbildung für Landwirte und andere Akteure in der Agrar- und Nahrungsmittelwirtschaft

Eine Bestandsaufnahme der Angebote für die technische und berufliche Bildung im afrikanischen Agrarsektor zeigt, dass es viel zu wenig Ausbildungsmöglichkeiten für junge Menschen gibt und dass die verfügbaren Ausbildungsprogramme nicht den Bedürfnissen der Privatwirtschaft oder der lokalen Verwaltungen entsprechen. Darüber hinaus untersuchten mehrere Studien den Qualifikationsbedarf für die Mechanisierung von Kleinbauern. So evaluierte beispielsweise eine

Studie in Sambia neue Ansätze zur Aus- und Weiterbildung für eine nachhaltige landwirtschaftliche Mechanisierung von Landwirten. Eine weitere Studie stützte sich auf Erfahrungen aus den USA und Deutschland, um Strategien zur Entwicklung der notwendigen Kenntnisse und Fähigkeiten für die Mechanisierung der landwirtschaftlichen Produktion zu identifizieren.

4. Stimulierung und Identifizierung von technologischen und institutionellen Innovationen

- a) *Screening nach vielversprechenden Innovationen aus Forschungs- und Innovationssystemen:* Die PARI Agricultural Innovation Database wird kontinuierlich weiterentwickelt. Inzwischen umfasst sie rund 200 wissenschaftlich getestete landwirtschaftliche Innovationen, die in tropischen und subtropischen Ländern eingesetzt werden könnten.
- b) *Innovationen von Kleinbauern:* Neue Forschung zielt darauf ab, Faktoren zu identifizieren, die die Innovationsbereitschaft und –fähigkeit von Kleinbauern beeinflussen. Die Ergebnisse werden 2019 veröffentlicht.
- c) *Skalierung von Innovationen:* Eine PARI-Studie dokumentierte und verglich Strategien zur Skalierung landwirtschaftlicher Innovationen in Afrika. Verschiedene Studien konzentrierten sich zudem auf Innovationen in bestimmten Wertschöpfungsketten in Afrika, wobei der Schwerpunkt auf Wertschöpfungsketten lag, die von den Grünen Innovationszentren unterstützt werden. Thematische Querschnittsforschung befasste sich mit dem Status, den Treibern und den Auswirkungen ausländischer Direktinvestitionen im afrikanischen Agrar- und Nahrungsmittelsektor.

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

Die Partner im PARI-Konsortium organisierten und nahmen an mehreren Veranstaltungen teil, um wichtige Interessengruppen einzubeziehen, darunter ein von PARI organisierter nationaler politischer Workshop in Malawi sowie wichtige afrikanische, deutsche und internationale Veranstaltungen (z.B. in Ruanda, Benin und Kanada). Die Öffentlichkeitsarbeit wurde durch die sozialen Medien und Publikationen unterstützt.

Ausblick für 2019-22

In den kommenden Jahren wird sich PARI verstärkt auf die Identifizierung von Investitionsmöglichkeiten in der Landwirtschaft und den ländlichen Gebieten Afrikas konzentrieren, um die Ernährungssicherheit zu verbessern und Beschäftigungs- und Einkommensmöglichkeiten zu schaffen. Die Forschung und die damit verbundenen Aktivitäten werden sich auf drei Themen fokussieren:

1. Investitionen in Innovationen zur Verbesserung der Produktivität und Widerstandsfähigkeit der Agrar- und Nahrungsmittelsysteme;
2. Beschäftigungs- und Einkommensmöglichkeiten im ländlichen Raum, insbesondere für Jugendliche und Frauen; und
3. Politikberatung und Politikreform.

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 as part of the *One World No Hunger* initiative by the German government. In 2018, the main achievements towards PARI's goals include:

1. PARI Innovation research with future-oriented impact analyses

- a) *Modelling and mapping direct and indirect impacts of potentially promising innovations:* The modelling team applied an agent-based model to assess the expansion potential of different *small-scale irrigation technologies*. The work will continue in 2019 resulting in a research report on small-scale irrigation in Niger and Mali, as well as Africa as a whole. In addition, research identifying innovations to reduce *post-harvest losses* in Senegal investigates where and to what extent post-harvest losses occur in the value chains. The modeling results will enable prioritization of investments into different innovations and different stages of the value chain. The study will be finalized in 2019.
- b) *Developing methodologies and concepts for strategic analysis of potentials and prospects:* PARI research in this area sought to determine whether investment in the agriculture and food sectors in Africa significantly increases overall economic growth and, hence, reduces food and nutrition insecurity. The estimation result suggests that agricultural growth, support by government commitment and quality of governance, Granger causes overall economic growth. Furthermore, PARI's continued its work on developing Rural Typologies of micro-regions in selected African PARI partner countries with a focus on infrastructure investments for rural development in Senegal and Burkina Faso.
- c) *Institutional analysis of the GICs in the context of their national agricultural innovation systems:* Research in this area focused on three themes. *First*, PARI research assessed opportunities for better integrating women in Africa's agriculture and food sector. *Second*, several studies identified patterns and impacts of mechanization in African agriculture. Research shows, for instance, that farmers who use tractors for land preparation can almost double their income by cultivating a much larger share of the land they own. *Third*, research focused on different aspects of nutrition. Among others, a study in Benin investigates the potential of using a digital tool to offer personalized nutrition advice and thereby improve the dietary habits of household members.

2. African ICT Platform for Agricultural Innovations: Strengthening the Innovation Potential through Information and Communication Technologies

Digitalization became a priority area in 2018. In this area, research is assessing the technological and economic feasibility of aggregating digital services in the food and agriculture sector in a single online platform. Furthermore, three stocktaking studies are being conducted in Kenya, Ghana and Nigeria which outline the status and potential of ICTs in the agriculture sector in the respective country. Drawing on the country research, a cross-cutting study will seek to identify the necessary framework conditions that can stimulate the development, scaling and impact of ICT-enabled services in food and agriculture. These studies will be published in 2019.

3. Vocational training for farmers and other actors in the agri-food value chain

Agricultural Technical and Vocational Education and Training (ATVET) was the second priority area in 2018. A review of ATVET systems in Africa was published which finds that there are far too few training opportunities for young people and that available training programmes do not match the needs of the private sector or local administrations. In addition, research activities focused on skill requirements specifically related to smallholder mechanization. For instance, a study in Zambia evaluates new approaches to training and education for sustainable agricultural mechanization for emerging farmers. Another study draws on experiences from the United States and Germany to identify strategies for developing the necessary knowledge and skills for agricultural mechanization.

4. Identifying and stimulating technological and institutional innovations

- a) *Screening for promising innovations from research and innovation systems:* The PARI Agricultural Innovation Database is continuously updated. It now contains around 200 scientifically tested agricultural innovations that could be applied in tropical and sub-tropical countries.
- b) *Farmer innovations:* Research got underway to identify factors that potentially drive the innovativeness of smallholder farmer. The results will be published in 2019.
- d) *Scaling innovations:* A PARI study documents and compares strategies for scaling agricultural innovations in Africa. Various studies also focused on innovations in specific value chains in Africa, with a focus on value chains supported by the Green Innovation Centers. Cross-cutting thematic research looked into the status, drivers and impacts of foreign direct investments in the African food and agriculture sector.

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

Partners in the PARI consortium organized and participated in several events to engage key stakeholders, including national policy workshop organized by PARI in Malawi, as well as major African, German and international events (for instance in Ruanda, Benin and Canada). Outreach activities were supported by social media and publications.

Outlook for 2019-22

In the coming years, PARI will focus increasingly on the identification of investment opportunities in the agriculture sectors and rural areas of Africa with the aim of improving food security and creating employment and income opportunities. The research and related activities will be structured around three themes:

1. Investments in innovations to improve the productivity and resilience of agricultural and food systems
2. Employment and income opportunities in rural areas, especially for youth and women
3. Policy Consultation and Policy Reform

1 Project overview

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 Centers (GICs) in 14 African countries as well as India. The research-based information generated in PARI serves to strengthen the integration of the GICs into national, regional and continental institutional partner settings, in order to enhance value chains contributing to 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 in the second phase (2018-19) continues to work in the same work packages with the slight change of adding Agricultural Technical Vocational Education and Training (ATVET) and Digitalization as priority research areas:

WP 1: PARI Innovation research with future-oriented impact analyses, including:

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 national agricultural innovation systems

WP 2: African ICT Platform for Agricultural Innovations: Strengthening the Innovation Potential through Information and Communication Technologies.

WP 3: Vocational training for farmers and other actors in the agri-food value chain.

WP 4: Research-based identification and stimulation of technological and institutional innovations, including:

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.

WP 5: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security

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">• UHO University of Hohenheim	Prof. Dr. Regina Birner, Head of Social and Institutional Change in Agricultural Development

The national partners in Africa (Benin, Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Mali, Malawi, Nigeria, Senegal, Togo, Tunisia and Zambia) and India include:

- Agricultural Research Council of Nigeria (ARCN), Nigeria
- Council for Scientific and Industrial Research (CSIR), Ghana
- Department of Agricultural Research Services (DARS), Malawi
- Ethiopian Development Research Institute (EDRI)
- Indian Council for Research on International Economic Relations (ICRIER)
- Institut de Recherche Agricole pour le Development (IRAD), Cameroon
- Institut d'Economie Rurale (IER), Mali
- Institut de L'Environnement et de Recherches Agricoles (INERA), Burkina Faso
- Institut National de Recherche Agronomique de Tunis (INRAT)
- Institut Togolaise de Recherche Agronomique (ITRA)
- Kenya Agricultural and Livestock Research Organization (KALRO)
- Lilongwe University of Agriculture & Natural Resources (LUANAR)
- National Agricultural Research Institute of Benin (INRAB)
- Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI)
- University of Nairobi, School of Computing and Informatics
- Université Cheikh Anta Diop de Dakar, Senegal (UCAD)
- Zambia Agriculture Research Institute (ZARI)

2 Activities and achievements in 2018

WP 1: PARI 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 technological innovations.

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

Research got underway to assess the **potential for small-scale irrigation investments** in Burkina Faso and Mali based on a combination of biophysical and socioeconomic factors using IFPRI's ex-ante irrigation potential assessment framework. A similar approach was previously used to assess the potential of small-scale irrigation potential and its profitability in a continent-level study across Africa South of the Sahara¹. The types of small-scale irrigation technologies under study include (1) motor pumps, (2) treadle pumps, (3) communal river diversion, and (4) small reservoirs. The work will continue in 2019, resulting in research reports on small-scale irrigation potential in the respective countries as well as a study on how to scale irrigation technologies across Africa.

Another area of research identifying **innovations to reduce post-harvest losses in Senegal** was also part of PARI's 2018 activities. The study determines where and to what extent post-harvest losses occur in the value chains. The study uses a Portable-Standard IMPACT (PS-IMPACT) model to undertake a cost-benefit analysis to assess whether significant efforts in post-harvest losses reduction are economically feasible. The model can be used to include an assessment/comparison of specific innovations in terms of their cost-effectiveness in reducing post-harvest losses. Modeling results would thus enable prioritization of investments into different innovations and different stages of the value chain. The study will be finalized in 2019 together with research on scaling out post-harvest technologies.

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

PARI research sought to determine whether investments in the agriculture and food sectors in Africa significantly increases overall economic growth and, hence, reduces food and nutrition insecurity. For this purpose, a study examined the **linkages between agricultural growth, food production, quality of governance, and overall economic growth** using panel data compiled from 44 African countries for a 53-year period from 1961 to 2014². The estimation result suggests that agricultural growth, government commitment, and quality of governance Granger causes overall economic growth. The study also identifies the 10 African countries where investment in the agriculture and food sectors is expected to yield the highest returns and the 10 African countries having the lowest returns in terms of reducing food insecurity and poverty. The result indicates that Botswana, Burkina Faso, Ethiopia, Kenya, Malawi, Mali, Mozambique, Rwanda, Seychelles, and Sierra Leone are the top 10 African countries where such an investment is expected to yield the highest returns. Cameroon, Congo, Egypt,

¹ Summarized in Policy Brief No. 12

² Published in ZEF-Discussion Papers on Development Policy No. 252: From Agricultural to Economic Growth: Targeting Investments Across Africa (2018)

Equatorial Guinea, Eritrea, Gabon, Gambia, Libya, Mauritania, and Somalia are the bottom 10 countries where such investment is expected to yield the lowest return.

Mapping agricultural, socio-economic and biophysical indicators for policy-making

PARI's previous work on developing **Rural Typologies** of micro-regions in selected African PARI partner countries continued in 2018 with a focus on **infrastructure investments for rural development in Senegal and Burkina Faso**. Combining GIS layers and middle-resolution satellite data on existing infrastructure (irrigation, rural electrification and roads) and the agricultural typology work developed for PARI 1.0, the research will identify the regions offering the best opportunities for further investments in infrastructure development for transport, electricity and connectivity. The study will be published in 2019.

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

Women in African Agriculture

Women are under-acknowledged participants in Africa's agriculture and food sector, supplying a large share of the labour, but facing significant obstacles, including unequal access to land, traditional division of labour, restrictions on mobility, unequal educational attainment, financial exclusion, and discrimination due to gender norms. As a result, women are being constrained to lower productivity jobs and earning less than men. The study of PARI on **integrating women into value chains** argues that the constraints faced by women need to be eliminated to effectively advance rural development and to avoid further solidifying gender roles and gaps. Working together and given the right opportunities for capacity-building and empowerment, women can form a strong force to challenge and disrupt the social norms that are stacked against them. They can do so through collective action, ascending to leadership positions in institutions at different levels of the value chain, through employment and by developing skills and capacities.

Supporting smallholder mechanization

In order to provide an overview on the **patterns and dynamics of mechanization in African agriculture**, PARI research assessed the farm level and value chain related mechanization over a 10 year period (2005-2014)³. The research suggests that there is a strong positive correlation of 0.52 between agricultural machinery growth and agricultural output growth (and vice versa). However, further research would be needed to confirm the existence of causality besides correlation.

Another study coordinated examined **whether private-sector initiatives can offer a promising means of promoting mechanization**⁴. The Propensity Score Matching (PSM) analysis indicate that farmers who access tractor services for land preparation can almost double their income by cultivating a much larger area of land. The findings also indicate that the demand for hired labor increases due to the expansion of the cultivated area and due to a shift from family labor, including that of children, to hired labor.

³ Published in ZEF Working Paper 169: Mechanization in African Agriculture: A Continental Overview on Patterns and Dynamics (2018)

⁴ Published in ZEF-Discussion Papers on Development Policy No. 262: Can Big Companies' Initiatives to Promote Mechanization Benefit Small Farms in Africa? (2018)

Further findings related to PARI studies on mechanization can be found in WP 3 on vocational training (page 11).

Improving nutrition

Despite some improvements towards reducing hunger, malnutrition remains to be a crucial challenge in the developing world. PARI Research analyzed the **interplay between production diversity and dietary diversity** across different seasons in rural Nigeria⁵. The study shows that in the post-harvest season, an increase in farm production diversification is associated with an increase in dietary diversity. On the other hand, production diversification does not have a significant contribution to the dietary diversity at the post-planting stage. The analysis also reveals that production diversification leads to better dietary diversity in particular for households in the second and third income quantiles.

Another research addresses the challenge of **vitamin A deficiency** in Zambia⁶. The research highlights orange or pro- Vitamin A maize as the most promising solution. The identified advantages of this approach are: the suitability of maize to be grown in nearly all parts of the country and by the majority of the rural based small-scale farmers; the government's input subsidy programme (FISP), making it accessible throughout the country; the local breeding by the national research organization (ZARI); and the increased appreciation and acceptance of orange maize by most farmers and consumers, both adults and children, relative to white maize, because of its nutritive value as well as its sweeter taste.

Another study in Benin investigates the potential of using an ICT-enabled Food Recommender system to offer **personalized nutrition advice** and thereby improve the dietary habits of household members. The Food Recommender is an Android-based application that collects anthropometric data, as well as the amount of food consumed by households. Using these data, the application calculates the actual intake and compares it to the recommended intake of macro- and micro-nutrients. Research was undertaken to evaluate the impact and usability of this system. The findings suggest that the implementation of this system has led to an improvement in fat and carbohydrate intakes and increases in vitamin E and folate intakes. The usability study highlighted several areas of improvement to adapt the system to local conditions, such as commonly used weight measures, language, education levels and cultural eating habits. The studies will be published in 2019.

WP2: African ICT Platform for Agricultural Innovations: Strengthening the Innovation Potential through Information and Communication Technologies

Research got underway in 2018 to assess the technological and economic feasibility of **aggregating ICT services in a single online platform**. To this end, the study seeks to identify elements of a suitable technological architecture, as well as to consider different dimensions of platform economics and governance. The research includes a qualitative study on the technical and economic feasibility of an aggregator platform for mobile agriculture services from the perspective of service providers, as well as a quantitative study on demand for a digital platform among agricultural value chain actors. The study will be published in 2019.

⁵ Published in BMC Public Health, 18 988: Production diversification, dietary diversity & consumption seasonality: panel data evidence from Nigeria (2018)

⁶ Published as FARA Research Report Volume 2 No. 14: Pathways for Improved Nutrition in Zambia: Lessons from Pro-Vitamin A rich Maize Innovation Platform

Also related to digitalization in African food and agriculture, three stocktaking studies are being conducted in Kenya, Ghana and Nigeria which outline the status and potential of ICTs in the agriculture sector in the respective country. Drawing on the country research, a cross-cutting study will seek to identify the necessary **framework conditions that can stimulate the development, scaling and impact of ICT-enabled services in food and agriculture**. Further research will also assess the potential for ICT-enabled services to improve the functioning of input, output and financial markets, using case studies on **marketing-related digital services** offered in the three countries. The studies will be published in 2019.

Finally, research is assessing the utility of a mobile application to offer **feeding advice for African dairy cattle**. A prototype for a mobile phone-based diet formulation tool⁷, which seeks to better inform African dairy farmers about optimizing animal nutrition through dietary composition choices, was tested in 2018. On-farm data collected in Kenya validate and analyze different feedstuffs in the laboratory in order to include their nutritional characteristics in the app's database. In addition, dairy farmers' opinions on the user-interface were obtained and the app's user-interface was simplified to make it more intuitive. This precision farming tool allows the smallholder farmers to increase milk yields, optimize energy and protein supply and to balance yields against feeding costs. The results of the research will be published in 2019.

Research related to the Food Recommender app is also described in WP1 (page 4).

WP 3: Vocational training for farmers and other actors in the agri-food value chain

A **review of the Agricultural Technical and Vocational Education and Training (ATVET) systems** in selected Sub-Saharan Africa countries shows that there are far too few training opportunities for young people and that currently, training offered does not match the needs of the private sector or local administrations.⁸ The research also concludes that ATVET focuses too heavily on production skills with limited attention paid to skills needed along the entire agricultural value chain. The study suggests that ATVET systems across Africa need to be fundamentally transformed into entrepreneurial and professional systems that will improve the skills of farmers and other value chain professionals through a combination of theoretical and practical training.

A second review study identifies **strategies for developing the necessary knowledge and skills for agricultural mechanization** by looking at historic examples from the United States and Germany.⁹ The comparative analysis shows that different strategies can be used towards this goal, such as primarily private sector-run training efforts favoured in the US or public-private vocational training initiatives offered in Germany.

Following this exploratory work, more in-depth research on **vocational training for mechanization** got underway in 2018. The objective of the study is to identify opportunities for promoting mechanization by building the skills and knowledge of farmers on how to use and maintain machinery and implements. To this end, the study will review existing training opportunities in Benin, Kenya, Mali

⁷ Published as conference paper: A Diet Formulation "App" For Small-Medium Scale Dairy Cattle Farmers In The (Sub-)Tropic (2018)

⁸ Published in ZEF Working Paper 164: Vocational Education and Training for Farmers and Other Actors in the Agri-Food Value Chain in Africa (2018)

⁹ Published as Iowa State University Working Paper No. 18009: How to create conducive institutions to enable agricultural mechanization: A comparative historical study from the United States and Germany (2018)

and Nigeria, evaluate training needs for mechanization and identify gaps in agricultural vocational training systems. The study will be published in 2019.

Another study in Zambia identifies **new approaches to training and education** for sustainable agricultural mechanization for emerging farmers. The study highlights in particular the potential of practical training programmes that can be self-sustaining and combine long-term training institutions for vocational training with short-term training organised by development actors or the extension system¹⁰.

WP 4: Research-based identification and stimulation of technological and institutional innovations (plus sub-topics)

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”)

The **PARI Agricultural Innovation Database** launched in 2016 includes technological, managerial and institutional innovations that could be applied and scaled up along agricultural value chains, in particular in tropical and sub-tropical countries. The database has the purpose of facilitating information exchange and documenting promising innovations in agriculture and the wider food sector. Further inputs were made to the database from PARI partners in Kenya and Ethiopia. Topics range from varietal types of sweet potatoes to tillage management for soil conservation.

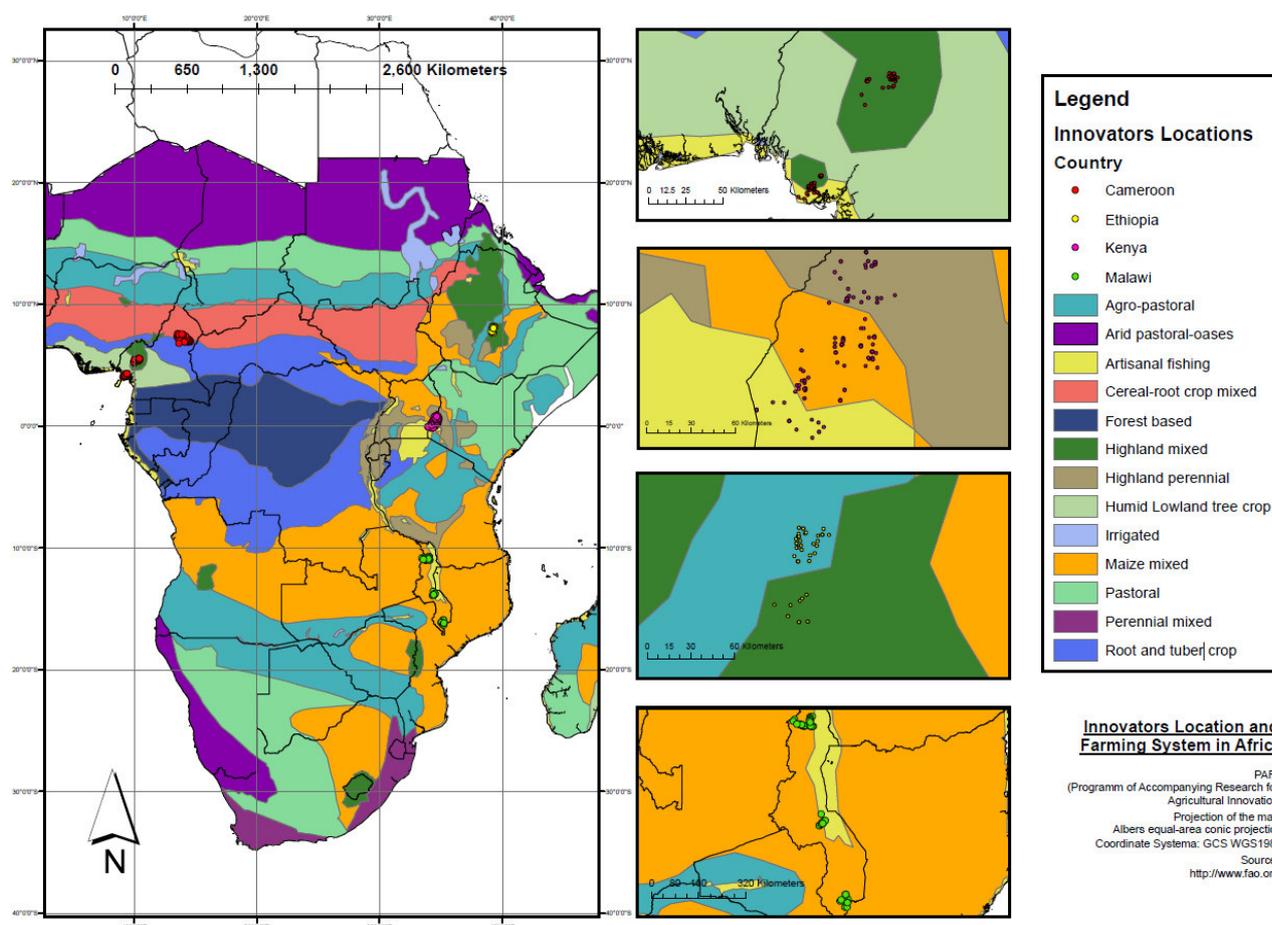
Activity II/2: Drivers of farmer innovativeness

Using data collected during the farmer innovation contests¹¹ implemented in Cameroon, Ethiopia, Kenya, Malawi and Zambia between 2016 and 2018, a new study got underway to assess the **drivers of innovativeness among farmers**. To identify factors that potentially drive farmer innovations, the GPS coordinates of the innovators were mapped and overlaid with different location specific indicators, including farming systems, accessibility (travel to major cities), population density, poverty, and yield of major crops. To illustrate the methodology used, Figure 1 shows the farming system map, overlaid with the location of the farmer innovators identified in four of the countries. The study will be published in 2019.

¹⁰ Summarized in Policy Brief No. 13

¹¹ Further information about all contests can be found at <https://research4agrinnovation.org/farmer-innovation-contests>

Figure 1: Location of innovators overlaid with farming systems



Data source: PARI/ZEF. Cartography: Carlos Garcia Lanchares

Activity II/3: Scaling of innovations

A research report was published that outlines and reviews various **strategies to scale agricultural innovations**.¹² Scaling up of agricultural innovations is necessary for any truly robust developments which are capable of reaching a large number of people. The report discusses the different routes from which up-scaling of technology is likely to occur in Africa, described as either 'sporadic' or 'systematized' pathways. Sporadic describes scaling without interventions or active dissemination which are usually novel solutions to problems that are significant barriers to productivity. These technologies tend to find easy acceptance due to many stakeholders having actively searched for solutions to the problems the new technology addresses. In contrast, systematized pathways require stepwise interventions to facilitate its scaling of an innovation beyond the environment in which it was generated. In this study FARA and its partners have proved, on a pilot basis, that the Integrated Agricultural Research for Development (IAR4D) approach using the Integrated Platforms can produce positive results for scaling innovations within a very short time.

Value chain-related research at the country level

¹² Published by FARA and ZEF as a book "Strategies for Scaling Agricultural Technologies in Africa" (2018)

Facilitated through the work of the National Partners, several studies were published during 2018 that outline innovation opportunities in selected value chains:¹³

- Innovation Opportunities in Mango Value Chains in Mali
- Innovation Opportunities in the Rice Value Chain in Nigeria
- Innovation Opportunities in Sweet Potato production in Kenya
- Innovation Opportunities in the Small Ruminants livestock sector in Benin
- Value Chain Assessment of Sidi Bouzid Sheep Production and Marketing in Tunisia
- Impact of Climate Change on Rice Farmer Income in Togo
- Analysis of the Dynamics and Obstacles to the Adoption of Technological Innovations: the Case of Rice Farming in Togo
- Marketing and Promotional Plan for Local Rice Based on Drivers of Traders and Consumers Preferences in Ghana
- Generating Employment and Increasing Income in Agricultural Value Chains and Thereby Fostering Food Security: Case Studies of Rice and Cotton in Benin and Senegal

Scaling innovations in the dairy sector

Research on the implementation of a **solar-based milk cooling system** developed by the University of Hohenheim was concluded in 2018. The cooling system was tested in Kenya and Tunisia and its socio-economic impacts assessed.¹⁴ It is based on the use of conventional milk-cans and ice produced in a solar powered freezer. Depending on the amount of ice used in the cans for cooling, the milk cans can be used to preserve milk quality for six to 16 hours. This technology offers steady ice production year round and assures the preservation of milk quality from the farm to the main collection center or the market. The gradual introduction of the technology provided an important upgrade to the current value chain. Furthermore, the solar powered milk cooling system showed great potential to make the dairy value chain more efficient in off-grid contexts by using clean energy.

In addition, research on **optimal feed for dairy livestock in Africa** continued in 2018. In semi-arid to arid tropical environments, cattle are regularly exposed to periods of low availability and poor nutritional quality of feed resources, in particular during dry seasons and drought years. Research evaluated the effects of feed intake level on the efficiency of rumen microbial protein synthesis (EMPS), nitrogen (N) excretion, and N balance in twelve 18-months old Boran (*Bos indicus*) steers with initial average live weight of 183 kg (standard deviation (SD) 15.2).¹⁵ According to the study, declining feed intake level in cattle offered tropical poor-quality forage below their MER linearly reduces rumen microbial protein yield, which may aggravate the negative effects of low dietary nutrient and energy supply in periods of feed shortage. The very low feed intake levels, N concentrations far below the assumed values for an adequate N supply to rumen microbes, do not negatively affect EMPS. Estimated duodenal microbial protein flow and EMPS observed in the present study are much lower

¹³ Country-level studies are available on the respective country page on the PARI website:

https://research4agrinnovation.org/pari_countries/

¹⁴ Published in Elsevier Science Direct as Volume 90: On-farm Milk Cooling Solution Based on Insulated Cans with Integrated Ice Compartment (2018) and ZEF Working Paper No. 172: Improving milk value chains through solar milk cooling (2018).

¹⁵ Published as Taylor & Francis Archives of Animal Nutrition Vol 73, 2019 – issue 2: Effects of feed intake level on efficiency of microbial protein synthesis and nitrogen balance in Boran steers consuming tropical poor-quality forage (2019)

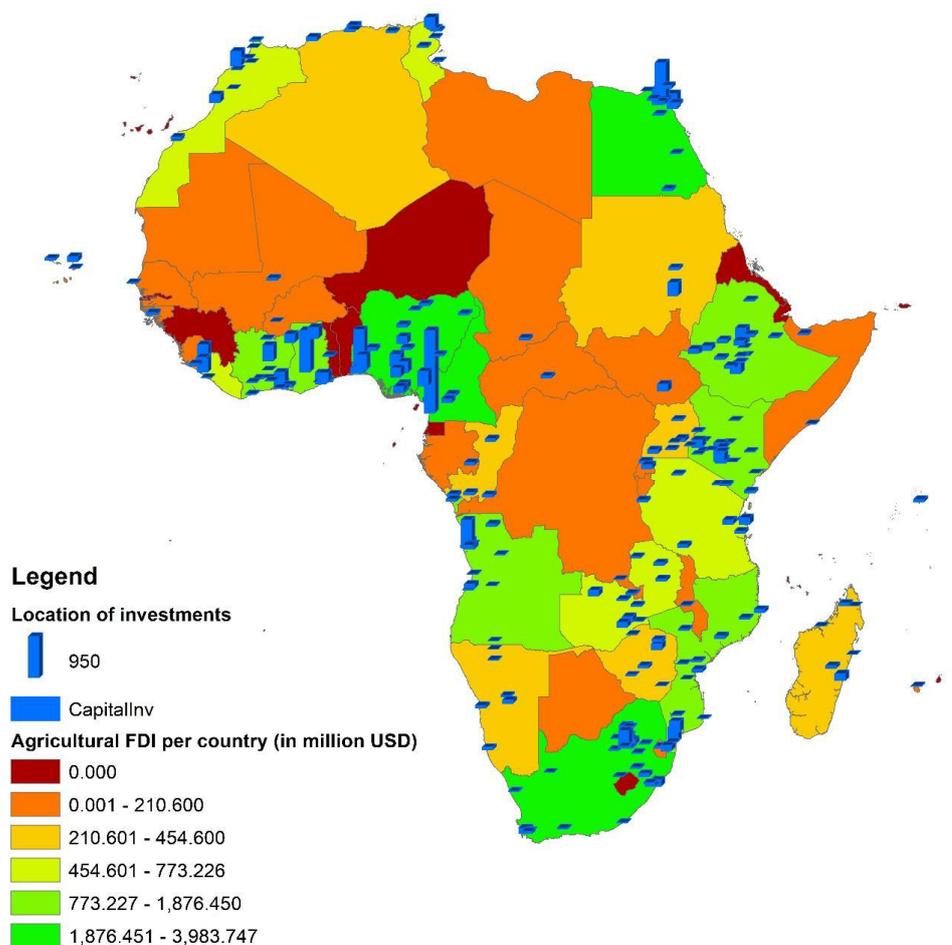
than those reported for temperate ruminant diets. Further research is thus needed to quantify the EMPS for animal genotypes and diets commonly found in the Tropics and Subtropics and to identify factors determining rumen microbial protein synthesis in order to be able to improve protein nutrition and use efficiency in tropical ruminants.

Foreign Direct Investment (FDI) in food and agriculture

FDI in food and agriculture is a potential tool for development, which if properly harnessed, can help create stable employment, raise incomes, boost agricultural productivity and encourage food security. Africa is currently receiving a far smaller share of FDI in this sector than is commensurate with its share of the global population. According to PARI research conducted in 2018 and published in 2019¹⁶, the continent only receives 10% of global food and agriculture FDI, despite being the second most populated continent and home to 17% of the global population. The sub-sectors receiving the largest share of food and agriculture FDI in Africa are crop production (18.5%), breweries and distilleries (16.1%), sugar and confectionary products (14.9%) and soft drinks (8.4%). There are large regional differences in investment inflows in Africa. Western, Eastern and Northern Africa receive the most investments. Within these regions, a few countries emerge as the main recipients: Nigeria, Egypt, Cameroon, South Africa, Ghana, Angola and Ethiopia (**Error! Reference source not found.**). The main drivers for FDI include the size of the domestic market in the recipient country, a country's supply of agricultural land, the quality of the infrastructure and regulatory environment, and the existence of previous investments.

¹⁶ Published as ZEF Discussion Paper No. 274: Foreign direct investment in the African food and agriculture sector: trends, determinants and impacts (2019); summarized in Policy Brief No. 14.

Figure 2: Location of food and agriculture FDI projects (excl. fertilizer) and investments per country



Source: Husmann and Kubik (2019) using data from www.fdimarkets.com (accessed January 16, 2018)

WP5: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security

Policy Briefs

In 2018 there was a significant effort to continue drafting policy briefs, with five more created in order to aid the on-going communications policy (available in English and partly in French and German):

- PARI Policy Brief No. 7: How to develop Knowledge and Skills for Mechanization in Africa
- PARI Policy Brief No. 8: Doubling the Maize Yield in Africa through better Crop Management
- PARI Policy Brief No. 9: Innovation for Sustainable Agricultural Growth in Africa – Insights from Research Dossiers on 12 PARI Partner Countries
- PARI Policy Brief No. 10: Innovations to Overcome Increasingly Complex Problems of Hunger
- PARI Policy Brief No. 11: Realizing the Potential of Digital Technologies for Agricultural Development in Africa

Policy Events

During 2018, PARI hosted or participated in several policy-relevant conferences in Germany, Africa and Canada to share research insights and policy recommendations and network with partners:

In Germany, PARI engaged with policy stakeholders and the general public in several high-profile events. Early in the year, PARI attended the **International Green Week** in Berlin where Dr. Heike Baumüller shared insights from a recent study visit of African researchers to India to learn about promising agricultural technologies for smallholder farmers.

The Youth Townhall Meeting with entrepreneur **Strive Masiyiwa** at Humboldt University was another important event in Berlin organised by PARI in December (Picture 1). The event was attended by around 200 people, including the members of the Alliance for a Green Revolution in Africa (AGRA) board, Stefan Schmidt of the German BMZ and as well as researchers from ZEF in Bonn. Among the attendees were approximately 50 current students from ZEF and the University of Bonn – originally from African countries such as Uganda, Ghana, Nigeria and Tanzania. Hence, a room full of Africans could have openly discuss and share their concerns regarding the future of the African agriculture and the opportunities to overcome these obstacles. The 3.3 million views and lively discussions on Mr. Masiyiwa's Facebook page also show that the event has had an impact far beyond Berlin.



Picture 1: Strive Masiyiwa with African students

In Africa, PARI organized a **National Policy Roundtable** in Malawi, in collaboration with the Department of Agricultural Research Services (DARS). High-level representatives from the public, private and non-governmental sectors gathered in Lilongwe on 11 July to discuss how innovations could spur development and job creation in Malawi's agriculture sector. The question of how to harness the capacities and motivation of the youth in the agriculture sector ranked particularly high among the policy priorities discussed.

PARI also hosted a side-event at the **African Green Revolution Forum (AGRF)** in Kigali in August. The AGRF is the most important annual gathering of policy stakeholders engaged in African agriculture. Leading researchers and policy makers from FARA, AGRODEP/IFPRI, ICRIER, Rwanda and ZEF presented their ideas on how to economically engage young people in rural development and agricultural value chains in Africa. The high-level panel speakers on this event were: Dr. Yemi Akinbamijo, Executive Director, Forum for Agricultural Research in Africa; Fred Swaniker, Founder and CEO, African Leadership University; Dr. Njack Kane, John A. Kufuor Foundation; and Ntiokam Divine, Founder and Managing Director, Climate Smart Agriculture Youth Network (Picture 2). The ultimate goal, panelists concluded, is to have as many rural youth as possible in Africa who will join the quest to reverse the food insecurity crisis that has led to more than 200 million people in the continent fighting starvation.



Picture 2: From left to right: Fred Swaniker, Njack Kane, Ntiokam Divine, Yemi Akinbamijo

Listed chronologically, the highlights from 2018 include:

- 17-28.01: 83rd International Green Week; Berlin, Germany
- 08-09.02: PARI Annual Meeting & Development of PARI 2.0; Cotonou, Benin
- 22.03: Malabo Montpellier Panel Report: Nourished; Berlin, Germany
- 11.07: PARI Roundtable highlights innovation opportunities for agricultural growth in Malawi; Lilongwe, Malawi
- 28.07: 30th International Conference of Agricultural Economists in Vancouver, Canada
- 29.08: Side-event at African Green Revolution Forum 2018 in Kigali, Rwanda
- 03.12: Youth Townhall Meeting with entrepreneur Strive Masiyiwa at Humboldt University in Berlin, Germany

Social Media Outreach

PARI is using social media, notably Twitter and Facebook, to disseminate key research findings. In 2018, PARI significantly increased its following on Twitter ([@PARI_ZEF](#)). From the founding of the Twitter account in September 2015 until December 2018, PARI's twitter outreach had grown to 1733 followers (Table 1).

Table 1: PARI Twitter outreach by 2018

MONTH 2018	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
IMPRESSIONS (K)	1.8	1.1	33.9	63.7	138	117.5	134.9	135.5	70.1	77.3	117.6	125.3
Followers	+19 (259)	+5 (264)	+134 (398)	+233 (631)	+152 (783)	+186 (969)	+270 (1239)	+120 (1359)	+100 (1459)	+116 (1575)	+87 (1662)	+71 (1733)

Several of the tweets reached a significant audience. In particular during the African Green Revolution Forum in September 2018, PARI's coverage of the event through several social media engagements received high impressions by our followers. Examples of popular tweets are included below. Efforts will be made in 2019 to raise the profile of [PARI's Facebook page](#) as an effective tool to reach African audiences.

PARI is also using the social media channels of the partner organisations to reach a wider audience. In particular FARA is connected to a large audience of relevant stakeholders in Africa. The FARA Twitter account currently has 22,900 followers who receive regular updates about PARI. FARA also has a significant Facebook outreach with 77,600 friends and 77,806 likes. PARI publications are also shared through FARA's Dgroups with 31,200 members. Website statistics show the success of these efforts. Notable among is a PARI study on strategies for scaling agricultural technologies in Africa¹⁷ which had reached 3,673 downloads and 11,211 hits by the end of 2018.

PARI achieved its most significant social media reach in Africa through the above-mentioned Townhall meeting with Strive Masiyiwa which was viewed by 3.3 million people through Mr Masiyiwa's Facebook page and shared 2,400 times. The event also attracted attention in the German media.¹⁸

¹⁷ Ajayi M.T, Fatunbi AO and Akinbamijo O. O (2018). Strategies for Scaling Agricultural Technologies in Africa. Forum for Agricultural Research in Africa (FARA), Accra Ghana.

¹⁸ [Afrika braucht eine grüne Revolution](#) by Robert von Lucius, Frankfurter Allgemeine Zeitung, 5 December 2018



PARI @PARI_ZEF
Africa's future will be decided in rural areas with small businesses as the backbone of the economy - Maria Flachsbarth [@BMZ_Bund](#) at [#AGRF2018](#) [@TheAGRF](#) [@FARAINfo](#) [@ZEFbonn](#) [@giz_gmbh](#) [@KoinangeJeff](#)
<pic.twitter.com/hPCEBQvhv6>

Impressions	8,209
Total engagements	45
Detail expands	13
Media engagements	8
Likes	8
Profile clicks	5
Retweets	4
Link clicks	4
Hashtag clicks	3



PARI @PARI_ZEF
We need to strengthen leadership, invest in unconventional methods and look at solutions outside the agriculture sector to address Africa's [#youth](#) challenge - [@FredSwaniker](#) from the [@ALAcademy](#) speaking at the PARI side-event at [#AGRF2018](#)

[@ZEFbonn](#) [@FARAINfo](#) [@oliverkirui](#)
<pic.twitter.com/Fh1MSQP4Kw>

Impressions	2,146
Total engagements	52
Media engagements	22
Likes	12
Retweets	7
Profile clicks	4
Link clicks	3
Hashtag clicks	3
Detail expands	1



PARI @PARI_ZEF
We need African solutions to African problems. We, the development partners, are ready to provide the needed support. - Stefan Schmitz, [@BMZ_Bund](#) at [#agr2018](#)

[@TheAGRF](#) [@ZEFbonn](#) [@FARAINfo](#) [@abfaithful1](#) [@oliverkirui](#) [@stefanschmitz17](#)
<pic.twitter.com/lmOSrsgv8>

Impressions	918
Total engagements	15
Profile clicks	7
Retweets	4
Likes	2
Detail expands	2

3 Summary of PARI activities in 2018 and outlook for 2019

Deliverable	Status by end-2018	Outlook for 2019	Lead organization(s)
Work package I: PARI Innovation research with future-oriented impact analyses			
Activity I/1: Modelling and mapping direct and indirect impacts of potentially promising innovations			
Modeling of different small-scale irrigation technologies	A policy brief on small-scale irrigation was completed. Research on small-scale irrigation in Niger, Mali and the whole of Africa got underway.	To be published	AGRODEP/IFPRI
Modelling innovations to reduce post-harvest technologies	Research got underway for Senegal and the whole of Africa	To be published	AGRODEP/IFPRI
Activity I/2: Developing methodologies and concepts for strategic analysis of potentials and prospects			
Study on targeting investments across Africa, 44 African countries analysed	Published as ZEF-Discussion Papers 252		ZEF, EDRI
Identifying infrastructure investments for rural development in Senegal and Burkina Faso	Research got underway.	To be published	AGRODEP/IFPRI
Activity I/3: Institutional analysis of the GICs in the context of their national agricultural innovation systems			
Study on women in African Agriculture	Published as ZEF Working Paper 175		ZEF
Study on patterns and dynamics of mechanization in African Agriculture	Published as ZEF Working Paper 169		ZEF
Study on private-sector initiatives to promote mechanization	Published as ZEF Working Paper 262		UHO
Study on improving nutrition in rural Nigeria	Published in BMC Public Health, 18 988		TUM
Study on the challenge of vitamin A deficiency in Zambia	Published as FARA Research Report Volume 2 No. 14		FARA
Study on Agricultural Extension Service and Technology Adoption for Food and Nutrition Security in Ethiopia	Published as FARA Research Report Volume 2 No. 4		FARA
Study on the food recommender system in Benin	Draft finalized	To be published	TUM
Work package II: African ICT Platform for Agricultural Innovations: Strengthening the Innovation Potential through Information and Communication Technologies			
Study on ICT platforms to aggregate digital services in agriculture	Research got underway	To be published	ZEF, University of Nairobi
Study on elements of an ICT innovation environment	Research got underway	To be published	ZEF, national partners

Study on the use of ICT-enabled services to facilitate access to markets	Research got underway	To be published	ZEF, national partners
Study on the diet formulation “App” for Small-Medium Scale Dairy Cattle Farmers	Published as a conference paper		UHO
Work package III: Vocational training for farmers and other actors in the agri-food value chain			
Historical study on strategies for developing the necessary knowledge and skills for agricultural mechanization	Published as Iowa State University Working Paper No. 18009		UHO, Iowa State University
Study on vocational education and training in the agri-food value chain in Africa	Published as ZEF Working Paper 164		ZEF
Study on skill requirements and training opportunities for mechanization	Research got underway	To be published	ZEF, UHO, national partners
Study on innovative approaches to skill development for mechanization in Zambia	Research got underway	To be published	UHO
Work package IV: Research-based identification and stimulation of technological and institutional innovations (plus sub-topics)			
Activity II/1: Screening for promising innovations from research and innovation systems			
PARI Agricultural Innovation Database	Database updated	To be further updated	ZEF (online platform), all partners (input)
Activity II/2: Drivers of farmer innovativeness			
Drivers of farmer innovativeness in Ethiopia, Kenya, Cameroon, Zambia and Malawi	Mapping of GPS coordinates of farmer innovations completed	GIS-based mapping and analysis of drivers. Study to be published.	ZEF
Activity II/3: Scaling of innovations			
Study on strategies for scaling of agricultural innovations in Africa	Published as a book		FARA, ZEF
Value chain-related research at the country level	Several studies published as FARA Research Reports	Remaining studies to be published	National partners, FARA
Solar-powered milk cooler	Published as ZEF Working Paper 172		UHO, national partners
Study on effects of feed intake level on efficiency of microbial protein synthesis and nitrogen balance	Research ongoing	To be published	UHO
Study on foreign direct investments in the African food and agricultural sector	Research ongoing	Published in 2019	ZEF
Work package V: Engaging with food and agriculture policy making to enhance approaches for innovation that improve food and nutrition security			
Study on tracking African policy commitments in food and agriculture	Research got underway	To be published	AGRODEP/IFPRI
Study on success stories in policy making for food and agriculture	Research ongoing	To be published	FARA, national partners

Formal and informal input into policy debates	National policy roundtables held in Malawi; engagement in African, German and international fora	continued	All partners
PARI policy briefs	6 briefs completed	Additional briefs forthcoming	All partners
PARI website	Online with minor updates	Updates ongoing	ZEF (online platform), all partners (contributions)

4 Publication List

During 2018, PARI has seen a significant growth in research outputs, including journal articles, studies and policy briefs. Below contains an exhaustive list which also includes outputs published in 2019, but for which most of the work was undertaken in 2018:

Publication Title	Partner	Geography	Year
The Little We Know: An Exploratory Literature Review on the Utility of Mobile Phone-Enabled Services for Smallholder Farmers	ZEF	General	2018
Recognizing and rewarding farmers' creativity through contests: experiences and insights from four African countries	ZEF	Ethiopia, Kenya, Malawi, Zambia	2018
Identifying Options for the Development of Sustainable Seed Systems – Insights from Kenya and Mali	ZEF	Kenya, Mali	2018
Vocational Education and Training for Farmers and Other Actors in the Agri-Food Value Chain in Africa	ZEF	General	2018
Innovations to Overcome the Increasingly Complex Problems of Hunger	ZEF	General	2018
Building farmers' capacity for innovation generation: Insights from rural Ghana	ZEF	Ghana	2018
Differential Impacts of Conservation Agriculture Technology Options on Household Income in Sub-Saharan Africa	ZEF	General	2018
Mechanization in African Agriculture: A Continental Overview on Patterns and Dynamics	ZEF	General	2018
Yield Effects of Selected Agronomic Innovation Packages in Maize Cropping Systems of Six Countries in Sub-Saharan Africa	ZEF	Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Nigeria	2018
Improving milk value chains through solar milk cooling	ZEF	Kenya, Tunisia	2018
Women in African Agriculture: Integrating Women into Value Chains to Build a Stronger Sector	ZEF	Africa	2018
How to create conducive institutions to enable agricultural mechanization: A comparative historical study from the United States and Germany	UHOH	Africa	2018
Can Big Companies' Initiatives to Promote Mechanization Benefit Small Farms in Africa?	UHOH	Africa	2018
Smartphone Apps as a new method to collect data on smallholder farming systems in the digital age: A case study from Zambia	UHOH	Zambia	2018
Times Have Changed – Using a Pictorial Smartphone App to Collect Time–Use Data in Rural Zambia	UHOH	Zambia	2018
Production diversification, dietary diversity & consumption seasonality: panel data evidence from Nigeria	TUM	Nigeria	2018

Publication Title	Partner	Geography	Year
Fostering India-Africa Exchange of Agricultural Technologies and Know-How	ZEF, FARA	Africa	2018
Climate Change Effect on Wheat Phenology Depends on Cultivar Change	ZEF, INRES	Africa	2018
Generating Employment and Increasing Income in Agricultural Value Chains and Thereby Fostering Food Security: Case Studies of Rice and Cotton in Benin and Senegal	UCAD, ZEF	Benin, Senegal	2018
From Agricultural to Economic Growth: Targeting Investments Across Africa	ZEF, EDRI	Africa	2018
Frontier Analysis and Agricultural Typologies	AGRODEP / IFPRI, ZEF	Burkina Faso, Ethiopia, Ghana, Kenya, Malawi, Nigeria, Togo and Zambia	2018
Strategies for Scaling Agricultural Technologies in Africa	FARA	Africa	2018
Status of Smallholders Agricultural Mechanization in Sub-Saharan Africa	FARA	Africa	2018
Small Scale Irrigation in Mali: Constraints and Opportunities	FARA	Mali	2018
Pathways for Improved Nutrition in Zambia: Lessons from Pro-Vitamin A rich Maize Innovation Platform	FARA	Zambia	2018
Marketing and Promotional Plan for Local Rice Based on Drivers of Traders and Consumers Preferences	FARA	Ghana	2018
Agricultural Extension Service and Technology Adoption for Food and Nutrition Security: Evidence from Ethiopia	FARA	Ethiopia	2018
Factors Affecting the Adoption of Innovative Technologies by Livestock Farmers in Arid Area of Tunisia	FARA	Tunisia	2018
Assessment of the Use of Conservation Agriculture on Durum Wheat Yield, Water and Nitrogen Use Efficiencies and Soil Health	FARA	Tunisia	2018
Smallholders' Access to Agricultural Equipment and Agro-Inputs in Mali	FARA	Mali	2018
Innovation Opportunities in the Small Ruminants livestock sector in Benin	INRAB, FARA	Benin	2018
Socio-Economic Analysis of Promising Innovations in Benin	INRAB, FARA	Benin	2018
Of Bulls and Bulbs – Aspirations and Perceptions of Rural Youth in Zambia	UHOH	Zambia	2018
Innovation Opportunities in Sweet Potato production in Kenya	KALRO, FARA	Kenya	2018
Impact of Agricultural Innovation Platforms on Smallholder livelihoods in Eastern and Western Kenya	KALRO, FARA	Kenya	2018
Innovation Opportunities in Mango Value Chains in Mali	IER, FARA	Mali	2018
Coping strategies with Climate Variability effects: The case of the village of Zignasso in Mali	IER, FARA	Mali	2018
Scaling Strategies for Agricultural Innovation in Nigeria	ARCN, FARA	Nigeria	2018
Innovation Opportunities in the Rice Value Chain in Nigeria	ARCN, FARA	Nigeria	2018
Documentation of Selected Outstanding Innovations in Nigeria	ARCN, FARA	Nigeria	2018
Impact of Climate Change on Rice Farmer Income in Togo	ITRA, FARA	Togo	2018
Analysis of the Dynamics and Obstacles to the Adoption of Technological Innovations: the Case of Rice Farming in Togo	ITRA, FARA	Togo	2018
Value Chain Assessment of Sidi Bouzid Sheep Production and Marketing in Tunisia : Challenges and Opportunities of Linking Breeders to the Markets	INRAT, FARA	Tunisia	2018
Foreign direct investment in the African food and agriculture sector: trends, determinants and impacts	ZEF	Africa	2019

Publication Title	Partner	Geography	Year
Suitability of Different Processing Techniques and Sales Options for Irish Potato (Solanum Tuberosum) Cultivars in Cameroon	FARA	Cameroon	2019
Adoption of Technologies and Crop Productivity in Ethiopia: The Role of Agricultural Information	FARA	Ethiopia	2019
Assessment of the Tunisian Olive Oil Value Chain in the International Markets: Constraints and Opportunities	FARA	Tunisia	2019
Evaluation of Modern Agricultural Technologies Adoption and Impact of Adoption on Productivity	FARA	Ethiopia	2019
Innovation Opportunities for Wheat and Faba Bean Value Chains in Ethiopia	FARA	Ethiopia	2019
Understanding the Engagement of Policymakers in the Success or Failure of Agricultural Innovation Processes: Lessons from Africa Countries	FARA	Benin, Ghana, Mali, Togo, Tunisia	2019
Effects of feed intake level on efficiency of microbial protein synthesis and nitrogen balance in Boran steers consuming tropical poor-quality forage	UHOH	Africa	2019

Policy Briefs published in 2018:

- [PARI Policy Brief No. 7: How to develop Knowledge and Skills for Mechanization in Africa](#)
- [PARI Policy Brief No. 8: Doubling the Maize Yield in Africa through better Crop Management](#)
- [PARI Policy Brief No. 9: Innovation for Sustainable Agricultural Growth in Africa – Insights from Research Dossiers on 12 PARI Partner Countries](#)
- [PARI Policy Brief No 10: Innovations to Overcome Increasingly Complex Problems of Hunger](#)
- [PARI Policy Brief No. 11: Realizing the Potential of Digital Technologies for Agricultural Development in Africa](#)