PARI Interim Report 2020

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submitted by

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in cooperation with PARI Partners

Program of Accompanying Research for Agricultural Innovation

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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.

Arbeitspaket 1: Investitionen in Innovationen zur Verbesserung der Produktivität und Resilienz von Agrar- und Ernährungssystemen

Mechanisierung: PARI Forschung zeigt, dass die Mechanisierung der landwirtschaftlichen Produktion in Afrika signifikante agronomische, ökologische und sozioökonomische Auswirkungen haben wird. Zwar kann Mechanisierung die Produktivität des Ackerlandes und der Arbeitskräfte erhöhen und damit die Armut reduzieren und die Ernährungssituation verbessern. Allerdings sind auch ergänzende Maßnahmen erforderlich, um negative Auswirkungen zu minimieren, wie Abholzung, Bodenerosion, Landnutzungskonflikte und geschlechtsspezifische Ungleichheiten. Bei der Mechanisierung von Kleinbauern kann Afrika von Indien lernen, wo fast die Hälfte der Kleinbetriebe landwirtschaftliche Maschinen wie Traktoren, Pumpen sowie motorisierte Hacken nutzen. Die Ausweitung der Möglichkeit, Landmaschinen auszuleihen, könnte den Zugang weiter fördern. PARI Forschung zeigt aber auch, dass analoge Lösungen wie Agenten und Telefonanrufe immer noch digitale Lösungen übertrumpfen.

Inputs: Die Forschung in diesem Themenbereich untersucht, wie die Produktion und nachhaltige Nutzung von Betriebsmitteln in Afrika verbessert werden kann. Die kleinflächige Bewässerung zum Beispiel könnte die Produktivität von Nutzpflanzen deutlich steigern, aber ihre Einführung wird voraussichtlich durch Wasserknappheit und Spannungen bei der Wasserzuteilung behindert werden. Strategien zur Nutzung der Wasserressourcen sind nötig, um effiziente und nachhaltige Bewässerungssysteme zu gewährleisten. In ähnlicher Weise müssten Einschränkungen für die Entwicklung der lokalen Düngemittelproduktion, wie z.B. schlechte Infrastruktur, ineffiziente Lieferketten, mangelnde Qualitätskontrollen und uneinheitliche politische Maßnahmen in Bezug auf Düngemittelsubventionen, angegangen werden.

Digitalisierung: Die Forschung befasst sich mit der Frage, wie ein günstiges Innovationsumfeld geschaffen werden kann, um den Einsatz digitaler Lösungen in afrikanischen Ernährungssystemen zu erhöhen. Groß angelegte Investitionen in die mobile Infrastruktur sind entscheidend, um einen schnellen, stabilen und erschwinglichen Zugang zu mobilen Netzwerken zu gewährleisten. Darüber hinaus müssen die Fähigkeiten von Anbietern und Nutzern digitaler Dienste verbessert werden, um die Entwicklung und Einführung digitaler Lösungen zu fördern. Außerdem muss das Innovationsumfeld für lokale Anbieter gestärkt werden, z. B. durch förderliche rechtliche Rahmenbedingungen, Innovationshubs und besseren Zugang zu Finanzmitteln für Unternehmer. Die nationale Gesetzgebung zum Schutz persönlicher Daten muss verbessert werden. Die Forschung zeigt, dass es zwar vermehrt entsprechende Vorschriften in Afrika gibt, diese aber oft nicht umgesetzt werden.

Sozioökonomische Aspekte der Tierhaltung: Eine länderübergreifende Studie zur Entwicklung der afrikanischen Tierhaltung sagt voraus, dass die Produktion tierischer Produkte auf dem Kontinent in den kommenden Jahren steigen wird, wobei die Produktion von Geflügel- und Schweinefleisch schneller steigen wird als die von Rindfleisch. Dabei haben Burkina Faso, Kamerun, Äthiopien, Nigeria, Senegal und Sambia das größte Potenzial für die Produktion tierischer Produkte wie Fleisch und Milch. Zu den vielversprechenden technologischen Innovationen gehören Brachiaria-Futter, verbesserte Futterkonservierung und künstliche Besamung, während Masterpläne für den Nutztiersektor, Programme zur Vermögensübertragung und indexbasierte Viehversicherungen ebenfalls vielversprechende sind.

Nachhaltigkeit / Anpassung an den Klimawandel: Forschung zeigt, dass sozioökonomische und technologische Lösungen an der Schnittstelle von nachhaltigem Landmanagement, Klimawandel und Energie Wirtschaftswachstum, Beschäftigung und Ernährungssicherung in der Sahelzone fördern könnten. Zu den sozioökonomischen Lösungen gehören die Verbesserung des Zugangs zu Märkten, die Stärkung sozialer Sicherheitsnetze, die Erhöhung von Investitionen in die Infrastruktur, die Förderung der Sicherheit von Landbesitz und die Ausweitung von Beschäftigungsmöglichkeiten außerhalb der Landwirtschaft. Darüber hinaus sind technologische Innovationen wie wassersparende Bewässerungstechniken, Mechanisierung, die Diversifizierung des Anbaus und die Renaturierung des Landes von entscheidender Bedeutung.

Arbeitspaket 2: Beschäftigungs- und Einkommensmöglichkeiten in ländlichen Gebieten, insbesondere für Jugendliche und Frauen

Beschäftigungsmöglichkeiten: Die Forschung untersucht die Widerstandsfähigkeit der afrikanischen Nahrungsmittelindustrie in Zeiten von Pandemien. Unternehmen in Südafrika, Nigeria, Kenia und Äthiopien erweisen sich, zumindest kurzfristig, als relativ widerstandsfähig, wobei kleinere Unternehmen stärker betroffen sind. Arbeitsplatzverluste und Gehaltskürzungen sind begrenzt, da die Unternehmen auf Schichtarbeit umstellen, um Social Distancing zu gewährleisten. Allerdings nehmen sie mit der Zeit zu. Ebenfalls sind viele Unternehmen von Erhöhungen der Rohstoffpreise und Schwierigkeiten in der Beschaffung von Rohstoffen betroffen.

Kapazitätsaufbau und Ausbildung: Durch die Partnerschaft mit dem African Economic Research Consortium (AERC) zielt PARI darauf ab, die Kapazitäten für wirtschaftspolitische Forschung und die Förderung von AbsolventInnen in Subsahara-Afrika zu stärken. Zu diesem Zweck werden AbsolventInnen für ihre Forschung in den PARI Themenbereichen finanziell und akademisch unterstützt.

Arbeitspaket 3: Beteiligung an der Gestaltung der Ernährungs- und Agrarpolitik, um Ansätze für Innovationen zu fördern, die die Ernährungssicherung und Lebensmittelsicherheit verbessern

Die viel beachtete PARI Studie "Von den Potenzialen zur Realität: Wie die afrikanische Lebensmittelproduktion gesteigert werden kann“ trägt die wichtigsten Erkenntnisse aus der PARI Forschung zusammen und ergänzt sie mit aktueller Literatur. So konnten Prioritäten für Investitionen und politische Maßnahmen ermittelt werden, die die Versorgung Afrikas mit Nahrungsmitteln für eine erschwingliche und gesunde Ernährung durch die nachhaltige Nutzung lokaler Ressourcen verbessern könnten. Der Bericht hebt zum einen systemische Maßnahmen hervor, die das gesamte Ernährungssystem betreffen. Zum anderen werden spezifische Maßnahmen herausgearbeitet, die die Produktivität in den Bereichen Pflanzenbau, Tierzucht, Verarbeitung und Ressourcenmanagement erhöhen können.

Des Weiteren befasst sich die Forschung in diesem Themenbereich mit der Rolle von Bauernverbänden als eine vielversprechende institutionelle Innovation. Viele afrikanische Bauernverbände haben mit Kapazitätsproblemen und Finanzengpässen zu kämpfen und sind weitgehend auf externe Ressourcen angewiesen, wodurch ihre Flexibilität eingeschränkt wird. Daher müssen die bestehenden Bauernverbände gefördert werden, zunächst durch den Aufbau der Kapazitäten von Führungskräften, die Erhöhung der Mitglieder und deren finanziellen Beitrag zur Unterstützung der Organisation sowie eine stärkere Einbindung von Bauernverbänden in politischen Prozessen.

Um die Ergebnisse von PARI zu verbreiten und in politische Prozesse einzubringen, organisierten die Partner des PARI-Konsortiums mehrere (hauptsächlich virtuelle) Veranstaltungen in 2020. Diese Aktivitäten wurden durch soziale Medien und Publikationen unterstützt, darunter Policy Briefs, Studien und Stellungnahmen. Online-Statistiken zeigen, dass PARI ein breites Publikum afrikanischer und politischer Stakeholder erreicht und einbindet.

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 (SEWOH)* initiative by the German government.

Work Package 1: Innovation investments to improve the productivity and resilience of agricultural and food systems

Mechanization: A cross-country study highlights significant perceived agronomic, environmental and socioeconomic effects of farm-level mechanization in African. While mechanization can enable higher land and labour productivity, thereby reducing poverty and enhancing food security, complementary policies are needed to minimize negative impacts, such as deforestation, soil erosion, land-use conflicts and gender inequalities. Regarding smallholder mechanization Africa can learn from India where almost half of small holdings of less than 2 ha use farm machinery in the form of tractors, diesel engine pump sets, electric pump sets and power tillers. The expansion of sharing mechanisms for farm machinery could further promote access. However, PARI research also shows that in practice, analogue solutions such as booking agents and phone calls still trump digital ones.

Inputs: Research explores the potential of scaling and sustainably managing input use in Africa. Small-scale irrigation, for instance, has great potential to increase crop productivity, but its adoption is likely to be constrained by water scarcity and tensions in water allocation. Strategic water resource development plans should be established to ensure efficient and sustainable irrigation schemes. Similarly, constraints to local fertilizer production, such as poor road infrastructure, inefficient supply chains, limited quality control and inconsistent policies regarding fertilizer subsidies, would need to be addressed.

Digitalization: Research identifies possible elements of an enabling environment to scale digital solutions in African food systems. Large-scale investments in mobile connectivity to ensure fast, stable and affordable access to mobile networks remain a key priority. In addition, skills of both digital service providers and users need to be improved to promote the development and adoption of digital solutions, and innovation environments for local providers need to be strengthened, for instance through conducive regulatory frameworks, investments in local innovation hubs and better access to finance for entrepreneurs. National legislation to protect data privacy will need to be strengthened and enforced. Research shows that related regulations are expanding across Africa, but many service providers fail to adhere to them fully.

Socio-economic aspects of animal husbandry: A cross-country study on the development of the African livestock sector predicts that production across all major livestock commodities will expand in the coming years, with poultry and pork growing faster than ruminant meat production. Burkina Faso, Cameroon, Ethiopia, Nigeria, Senegal and Zambia have the highest potential for both meat and milk production. Promising technological innovations include Brachiaria forages, improved fodder conservation and artificial insemination, while livestock master plans, asset transfer programs and index-based livestock insurances are high-potential policy innovations.

Sustainability / climate change adaptation: Research shows that socio-economic and technological solutions at the nexus of sustainable land management, climate change and energy have the potential to advance economic growth, employment and food security in the Sahel region. Socio-economic solutions include improving access to markets, strengthening social safety nets, increasing investments in transport and energy infrastructures, promoting land tenure security, and expanding off-farm employment opportunities. In addition, technological innovations, such as

water use efficient irrigation techniques, crop diversification, mechanization and land restoration practices, are also key.

Work Package 2: Employment and income opportunities in rural areas, especially for youth and women

Employment opportunities: Research assesses the resilience of the food and beverage manufacturing sector in times of pandemics. Companies in South Africa, Nigeria, Kenya and Ethiopia prove relatively resilient, at least in the short run, but smaller companies are affected more severely. Job losses and salary reductions are limited as companies move to shift work in order to ensure social distancing, but increase over time. Widespread disruptions in sourcing of raw materials and increases in input prices are also felt by many companies.

Capacity building and education: Through its partnership with the African Economic Research Consortium (AERC), PARI aims at enhancing the capacities for economic policy research and graduate training in sub-Saharan Africa. To this end, financial and academic support is being provided to postgraduate students to undertake research within the thematic areas of PARI. Overall, 15 master thesis and 5 PhD dissertations are being funded.

Work Package 3: Engaging with food and agriculture policy making to enhance food and nutrition security

A high-profile PARI study "From Potentials to Reality: Transforming Africa's Food Production" provides an opportunity to distil key findings from PARI research combined with other state-of-the-art literature in order to identify investment and policy priorities to boost African food supplies for affordable and healthy diets from the sustainable use of the continent's resources. The report highlights systemic actions and investments that cut across the whole food and agricultural system and include economy wide policies and governance; as well as specific sub-sector actions and investments enhance productivity in crops, animal production, processing and natural resource management.

Research also focuses on the role of farmers' organisations as one promising institutional innovation. Many FOs face capacity and financial constraints, and largely rely on external resources which limits their flexibilities. Thus, existing FOs require energizing, first through building the capacity of the existing leaders, increasing the membership base and their financial contribution to support the operations of the organizations, and by creating opportunities for the FOs to engage policy makers on a regular basis.

To disseminate PARI findings and input into policy processes, partners in the PARI consortium organized and participated in several (mainly virtual) events in 2020. Outreach activities were supported by social media and publications, including policy briefs, studies and opinion pieces. Online statistics show that PARI is reaching and engaging a wide audience of African policy stakeholders.

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 through its network of 14 Green Innovation Centers (GICs) 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. 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**.

Core partners

Partner organizations	Focal point
• **ZEF** Center for Development Research University of Bonn	Prof. Dr. Joachim von Braun, Project Director Dr. Heike Baumüller, Project Coordinator
• **FARA** Forum for Agricultural Research in Africa	Dr. Yemi Akinbamijo, Executive Director Dr. Wole Fatunbi, Project Coordinator
• **AGRODEP** African Growth and Development Policy Modeling Consortium (AGRODEP) hosted by Akademiya2063	Dr. Ousmane Badiane, Executive Chairperson, Akademiya2063 Dr. Getaw Tadesse, Project Coordinator
• **UHO** University of Hohenheim	Prof. Dr. Regina Birner, Head of Social and Institutional Change in Agricultural Development Dr. Thomas Daum, Project Coordinator

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

- African Economic Research Consortium (AERC)
- Agricultural Research Council of Nigeria (ARCN), Nigeria
- Council for Scientific and Industrial Research (CSIR), Ghana
- Department of Agricultural Research Services (DARS), Malawi
- 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'Environment 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)
- Makerere University, Uganda
- National Agricultural Research Institute of Benin (INRAB)
- Policy Studies Institute (PSI, formerly Ethiopian Development Research Institute EDRI), Ethiopia
- Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI)
- University of Ghana – Institute of Statistical, Social and Economic Research (ISSER)
- 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 2020

WP 1: Innovation investments to improve the productivity and resilience of agricultural and food systems

In this work package, PARI research seeks to develop and apply approaches to identify the most cost-effective technological and institutional innovations for specific locations, target audiences, commodities and value chain stages across Africa that have the highest impact with regard to the PARI / SEWOH goals.

a) Mechanization along value chains

Research under this theme focuses on mechanization at the **farm level** as well as in the **food processing sector**. Details on the former are provided in this section, while research related to the food processing sector is described under WP2.

How is mechanization changing the face of African agriculture?

Farm-level mechanization will change the face of African farming, according to a cross-country comparative analysis covering Nigeria, Kenya, Benin and Mali.[1] On the upside, mechanization can enable higher land and labour productivity, thereby reducing poverty and enhancing food security. On the downside, mechanization - in the absence of complementary policies - can contribute to deforestation, soil erosion, land-use conflicts, and gender inequalities. To minimize possible negative effects while harnessing the potential of mechanization, accompanying policies are needed.

How can local manufacturing of agricultural machinery be promoted?

In 2020, the research partners in the four countries launched a new research project which assesses the opportunities and challenges for **local manufacturers of machinery**. Using a survey and qualitative mapping exercise among local manufactures and other stakeholders, the research explores the status of local manufacturing and assess the challenges that companies face and identify supporting measures to enable such manufacturers to thrive.

How has India performed in farm-level mechanization among smallholders?

Another study published in 2020 highlights the progress that has been made in advancing **farm mechanization in India**, especially the use of tractors.[2] Between the 1970s and 2019, India transformed from a net importer to a net exporter of tractors. While larger firms are more mechanized, almost half of small holdings of less than 2 ha use farm machinery in the form of tractors, diesel engine pump sets, electric pump sets and power tillers. To improve access for smallholders, the paper recommends the expansion of sharing mechanisms for farm machinery, for instance through community centres or digital platforms.

How effective are digital technologies to facilitate sharing of farm machinery?

Another study, conducted in Nigeria and India, provides further insights on the use of **digital platforms to share farm machinery** (also referred to as 'uberization').[3] The research shows that such platforms have potential for tractor service markets. However, the advantages of ICT-based solutions over more traditional ways of organizing service markets are more mixed than commonly assumed. The paper finds that analogue solutions such as booking agents and phone

[1] Daum et al. (2020) Perceived effects of farm tractors in four African countries, highlighted by participatory impact diagrams.
[2] Gulati & Juneja (2020) Farm Mechanization in Indian Agriculture with Focus on Tractors.
[3] Daum et al. (2020) Uber for tractors? Opportunities and challenges of digital tools for tractor hire in India and Nigeria.

calls still trump digital ones and highlights the need for a supportive environment such as building (digital) literacy.

b) Inputs (seed, fertilizer) and finance for smallholders and rural small businesses

What is the potential of small-scale irrigation to boost agricultural production in Africa?

PARI's research on **irrigation** assesses the potential for small-scale irrigation investment in Niger and Mali.[4] The results show that small-scale irrigation can increase crop productivity in both countries, but its adoption may be constrained by water scarcity and tensions in water allocation. Strategic water resource development plans should be established to ensure efficient and sustainable irrigation schemes, especially for areas with high potential profitability.

How can local fertilizer production be promoted in Africa?

Another study focused on the potential to increase **fertilizer** supplies and access in Africa.[5] Comparing experiences in Ethiopia, Nigeria and Uganda, the researchers find that Ethiopia has been most successful at ensuring uninterrupted access to inorganic fertilizer across seasons at the lowest possible prices for its smallholders. In contrast, Uganda and Nigeria have struggled in this regard. In all countries, the policy environment is not conducive for the development of a competitive fertilizer industry at the national or regional level. Key constraints include poor road infrastructure, inefficient supply chains, limited quality control and inconsistent policies regarding fertilizer subsidies.

How can the growing use of herbicide in Sub-Saharan Africa be sustainable in the long run?

New research launched in 2020 assesses which technological and institutional innovations are needed to ensure that the rapid expansion of **herbicide** use in Africa unfolds in ways that is economically, socially and environmentally sustainable. To this end, the research investigates to what extent the African herbicide revolution is embedded or curtailing a holistic approach to crop and pest management. It also reviews the policies governing the use of agro-chemicals in selected countries and map the institutions and organizations that matter for the sustainable and safe use of agro-chemicals. Research outputs are expected in 2021.

c) Digitalization in food and agriculture

What are the elements of an enabling environment to scale digital solutions in African food systems?

Drawing on research conducted in Kenya, Nigeria and Ghana in 2019 in collaboration with local partners, a cross-country analysis outlines necessary elements of an **enabling environment to scale digital solutions in African food systems**.[6] The study highlights large-scale investments in mobile connectivity to ensure fast, stable and affordable access to mobile networks as one of the key priorities. In addition, skills of both digital service providers and users need to be improved to promote the development and adoption of digital solutions, and innovation environments for local providers need to be strengthened, for instance through conducive regulatory frameworks, investments in local innovation hubs and better access to finance for entrepreneurs.

[4] Olayide et al. (2020) Targeting Small-Scale Irrigation Investments using Agent-Based Modeling: Case Studies in Mali and Niger.
[5] Olaleye and Edje (2020) Mobilizing Investments in Fertilizer Production and Distribution in Ethiopia, Nigeria and Uganda.
[6] Baumüller and Addom (2020) The Enabling Environments for the Digitalization of African Agriculture.

Adequate regulations to ensure **data privacy and protection** are another important element of such an enabling environment. A review of related regulations across Africa finds that significant progress is being made in the development of legal frameworks, in part driven by the adoption of the African Union Convention on Cyber Security and Personal Data Protection in 2014, but many countries still fall short in the implementation and enforcement of their laws.[7] A closer look at data protection measures implemented by digital solutions providers in agriculture shows that most do not adequately protect the privacy of their customers' data even where they are legally required to do so.

Are African governments and digital service providers protecting the data privacy rights of users?

In addition, a new research project was launched to investigate the **use and impact of Information and Communication Technologies (ICTs) among agricultural intermediaries**. To this end, surveys with agro-output and agro-input dealers as well as extension agents are being undertaken in Kenya, Nigeria, Ghana and Mali. The research assesses the digital literacy levels among intermediaries, how different ICTs are being used by intermediaries in their professional activities and how their use has impacted reach, quality and profitability of service provisions. Research outputs are expected in 2021.

How do agricultural intermediaries make use of ICTs in their professional activities?

d) Socio-economic aspects of animal husbandry

A study of the **African livestock sector** analyses the patterns and changing structures of the sector, identifies high-potential countries for future development and explores innovations that can help to address the complex trade-offs to ensure a sustainable livestock sector.[8] Production across all major livestock commodities is expected to expand in the coming years, with poultry and pork growing faster than ruminant meat production. Burkina Faso, Cameroon, Ethiopia, Nigeria, Senegal and Zambia have the highest potential for both meat and milk production. Based on a series of country studies conducted by national partners in Ethiopia[9], Kenya and Mali[10], the study identifies a number of promising innovations for the livestock sector, including improved forages, improved fodder conservation, artificial insemination combined with estrus synchronization, intensive beekeeping, livestock masterplans, livestock asset transfer programs, index- based livestock insurances and livestock market information systems.

What is the growth potential of the African livestock sector?

New research launched in 2020 assesses the **development potential of different livestock farming systems in Africa**. To this end, the research maps livestock farming systems that can be found on the continent. The research focuses on identifying the trade-offs involved in alternative development pathways of these livestock farming systems, taking the interaction with crop farming into account. Pathways may include intensification, integration and specialization. Possible trade-offs includes impacts on poverty, gender, nutrition, environment (greenhouse gas emissions, nitrogen and water cycles, animal genetic diversity and biodiversity), and animal welfare. Research outputs are expected in 2021.

Which livestock farming systems have the highest potential for sustainable growth in Africa?

[7] Chichaibelu et al. (forthcoming in 2021) Data Protection in Africa: A Review of National Legislation and Data Privacy Provisions in Digital Agricultural Services

[8] Seré (2020) Investing Sustainably in African Livestock Development: Opportunities and Trade-Offs.

[9] Tegegne & Feye (2020) Study of Selected Livestock Innovations in Ethiopia

[10] Kergna & Niallibouly (2020) Potential and Drivers of Livestock Production in Mali.

e) Sustainability / climate change adaptation

How can measures to combat climate change and land degradation promote economic growth in the Sahel region?

A collaborative research effort brought together leading authors from the Sahel region to identify **investment opportunities to advance economic growth, employment and food security in the Sahel region** through actions at the nexus of sustainable land management, climate change and energy. Country studies were prepared for Burkina Faso, Ethiopia, Mali, Niger, Nigeria, Senegal and Sudan and presented in virtual seminars.[11] A cross-country synthesis of the findings concludes that socio-economic solutions, such as improving access to markets, strengthening social safety nets, increasing investments in transport and energy infrastructures, promoting land tenure security, and expanding off-farm employment opportunities, can greatly contribute to rural development in the Sahel.[12] In addition, technological innovations, such as water use efficient irrigation techniques, crop diversification, mechanization and land restoration practices, are also key. Moving these solutions forward at the policy level will require active stakeholder consultation and participation in policy formulation, effective policy monitoring, and less reliance on external funding.

How can negative impacts of droughts be reduced in the Sahel region?

Follow-up research to be conducted jointly with AGRHYMET Regional Centre of the Permanent Interstate Committee for Drought Control in the Sahel (CILSS) was launched in 2020 to identify innovative solutions to address the **impacts of drought in the Sahel region**. Specifically, the research assesses key patterns of agricultural drought in the Sahel region; estimates the direct economic costs of drought at household level; and analyses the policy landscape for water governance and management. Based on these findings, the research will identify promising interventions that can effectively reduce drought damages, including in the areas of water management, sustainable land management, and formal and informal water governance mechanisms. Research outputs are expected in 2021.

What is the role of agro-ecological approaches in transforming African agricultural systems?

In addition, new research was launched in 2020 which investigates the role of the **agro-ecological approaches** in African agriculture. Specifically, the research examines how such approaches could be adapted to a context that is characterized by a high diversity of farming systems, geographic conditions and socio-economic features. The research explores the optimal mix between agro-ecology and the existing set of agricultural models that can help transform African agriculture to meet the long-term food security and poverty reduction goals while ensuring environmental protection and social justice. Research outputs are expected in 2021.

WP 2: Employment and income opportunities in rural areas, especially for youth and women

In this work package, PARI research is examining options for generating jobs and other income opportunities in the rural economy in general and specifically for the rural youth and women. The focus is on employment along agricultural value chains (e.g. logistics, processing, retail) as well as supporting businesses (e.g. financial services, machinery operators, mechanics).

[11] Available at https://research4agrinnovation.org/experts-actions-sahel/.

[12] Mirzabaev et al. (2021) Land, Climate, Energy, Agriculture and Development in the Sahel: Synthesis paper of case studies under the Sudano-Sahelian Initiative for Regional Development, Jobs, and Food Security.

a) Employment opportunities

How can mechanization and automation of food processing create high-quality jobs for all?

Research investigates where and under what conditions **mechanization and automation in the African food and beverage industry** will generate employment and lead to equitable income gains. With a focus on South Africa, Nigeria, Kenya and Ethiopia, the study assesses the status and potential of mechanization/automation in the African food and beverage industry; evaluates the skill needs, availability of skilled labour and the status of related education opportunities; and assesses the labour impacts of mechanization/automation to identify the most promising entry points for investments to generate employment.

How are Covid-19 containment measures impacting African food and beverage manufacturing firms?

Due to the Covid-19 pandemic, the enterprise surveys had to be delayed until late 2020. In the meantime, a new study with the same companies was launched to examine the **resilience of the food and beverage manufacturing sector in times of pandemics**. Phone surveys conducted in May and October show that on average, companies proved relatively resilient, at least in the short run, but smaller companies were affected more severely.[13] Job losses and salary reductions were limited as companies moved to shift work in order to ensure social distancing, but increased over time. Widespread disruptions in sourcing of raw materials and increases in input prices across both rounds occurred, and many companies called on their governments to improve access to raw materials at reasonable prices.

b) Capacity building and education

As part of PARI's collaboration with the African Economic Research Consortium (AERC), PARI aims to contribute to AERC's effort at **enhancing the capacities for economic policy research and graduate training in sub-Saharan Africa**. Within this, financial and academic support is being provided to postgraduate students to undertake research within the thematic areas of PARI. Overall, 15 master thesis and 5 PhD dissertations are being funded.

c) Youth engagement

How can more jobs be created for the youth in farming and agribusiness?

A consortium of PARI partners launched a series of country studies in Benin, Ethiopia, Tunisia and Senegal in 2020 which explore how to create **productive employment opportunities for the African youth** in farming and agribusiness, with a focus on young entrepreneurs within the sector. To this end, the research assesses both the success factors as well as main challenges and entry barriers for the youth in farming and agribusiness. These insights will inform the formulation of policy interventions to support them. Data collection in the four study countries uses the same survey instrument and sampling strategy which will then also allow for cross-country comparisons. Research outputs are expected in 2021.

[13] Baumüller et al. (forthcoming in 2021) Impact of Covid-19 on African food and beverage manufacturing companies: Evidence from selected African countries.

WP 3: Engaging with food and agriculture policy making to enhance food and nutrition security

This work package focuses on identifying and implementing strategies to support **policy reforms related to agricultural innovation, rural development and food security in Africa**. The target audience includes policy-makers engaged at national, sub-regional and continental levels in Africa as well as global policy processes that shape the framework conditions for African agriculture, such as trade, investment and climate change policies. In addition to the cluster leaders, key African players to engage in this context will include the African Union, NEPAD, the regional economic communities, national policy think tanks and the Malabo-Montpellier Panel.

a) Political and institutional framework conditions

How can Africa boost its food supplies through the use of its own resources?

The high-profile study "From Potentials to Reality: Transforming Africa's Food Production", co-published with Akademiya2063, provided an opportunity to distil key findings from PARI research combined with other state-of-the-art literature in order to identify investment and policy priorities to **boost African food supplies for affordable and healthy diets from the sustainable use of the continent's resources**.[14] The report highlights systemic actions and investments that cut across the whole food and agricultural system and includes economy wide policies and governance; as well as specific sub-sector actions and investments to enhance productivity in crops, animal production, processing and natural resource management.

How should Covid-19 containment measures be implemented to minimize negative impacts on food security?

Research investigates how to minimize negative **impacts of Covid-19 containment measures on food security**. One study highlights the dramatic dilemma between lockdowns and food security in five African countries, especially with regard to economic access to food, and shows that open debates on nutritional consequences influenced lockdown policies in democratic countries.[15] Another study shows that "nutrition-sensitive" lockdowns can help to reduce trade-offs between pandemic control and food security.[16] For instance, measures such as bans on major events have great benefits in fighting pandemics, but have little effect on nutrition.

How could farmers' organisations be strengthened to best serve their members?

Research also focuses on the role of **farmers organisations** as one promising institutional innovation to boost agricultural productivity, link farmers to markets and ensure that the interests of farmers are represented in policy processes. A comparative analysis in Senegal, Uganda and Zambia shows that FOs are more or less well-structured, but a sizeable majority of small-scale producers is yet to be part of the organized FOs.[17] Many FOs face capacity and financial constraints, and largely rely on external resources which limits their flexibilities. Thus, existing FOs require energizing, first through building the capacity of the existing leaders, increasing the membership base and their financial contribution to support the operations of the organizations, and by creating opportunities for the FOs to engage policy makers on a regular basis.

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[14] Baumüller et al. (2020)

[15] Birner et al. (2020) 'We would rather die from Covid-19than from hunger' -Exploring lockdown stringencies in five African countries

[16] Daum et al. (2020) Between pandemics and famines: Towards nutrition-sensitive lockdowns during Covid-19 and beyond

[17] Kampmann & Kirui (2021) Role of Farmers' Organizations in Agricultural Transformation in AfricaOverview of Continental, Regional, and Selected National Level Organizations.

b) Strengthening multi-actor partnerships and pan-African networks

PARI continued to strengthen its existing pan-African networks in the second phase of PARI:

- Particular emphasis was placed on linking and building the capacities of **AGRODEP members** through joint workshops and research development as well as mentoring by senior IFPRI researchers.
- Widespread outreach activities and dissemination of PARI research findings among **FARA's extensive network of policy actors** in Africa served to raise awareness of PARI among key stakeholders, engage new researchers in PARI activities and foster linkages between the research community and policy makers.

Research and capacity building initiatives outlined above also sought to strengthen and expand pan-African research partnerships:

- The **collaboration with AERC** serves to build a network of researchers working on issues related to agricultural and rural development in Africa. PARI researchers will directly engage with students and faculty members to provide input into research activities, co-publish articles and participate in training activities.
- Through the collaborative research with **research partners in the Sahel region**, including the new partnership with AGRHYMET-CILSS, PARI has significantly strengthened its research network in the region. Follow-up research with these network partners will be conducted in 2021 (see WP1).

c) Evidence-based input into high-level African policy fora

Research publications

Download statistics show that PARI publications are attracting much attention among policy stakeholders. In particular studies published and circulated through the FARA network are reaching a large audience of primarily African readers (Table 1). Beyond the website, FARA circulates new publication directly to 36'000 people through its DGroups.

Table 1: Download statistics for selected PARI publications published by FARA

Title	Downloads	Hits
Enhancing Youth Employment Opportunities in Rural Economies of Ghana	948	4224
The Status of ICT Infrastructure, Innovative Environment and ICT4AG Services in Agriculture, Food and Nutrition in Kenya	931	5952
Digitalization in Agriculture, Food and Nutrition - A Case Study of Nigeria	840	1452
A Review of Youth Employment Initiatives in Ghana: Policy Perspective	820	6636
Enhancement of Employment and Income Opportunities for Rural Youth in Ethiopia: A Review of Four Large Youth Employment Initiatives	792	5056
Status and Readiness for ICTs in Ghana's Agriculture	721	3390
Enhancing Youth Employment Opportunities in Rural Economies in Ethiopia	502	2198
Assessment of Youth Employment Initiatives in Malawi: Implementation Realities and Policy Perspective	450	2500
Enhancing youth Employment Opportunities in Rural Economies in Benin	430	2190
Mechanization and Skill Development for Productivity Growth, Employment and Value Addition: Insights from Benin	413	998

Policy Briefs

- Policy Brief No. 19: Levelling the Playing Field for Women in African Agriculture
- Policy Brief No. 20: What are the Effects of Agricultural Mechanization?
- Policy Brief No. 21: The Forgotten Agriculture-Nutrition Link
- Policy Brief No. 22: Can Mobile Money Facilitate Cash Transfers to Farmers and the Rural Poor in the COVID-19 Context?
- Policy Brief No. 23: Like Uber for Tractors? How to strengthen the rural sharing economy in India and Africa
- Policy Brief No. 24: Emerging Impacts of COVID–19 on the South African Food and Beverage Manufacturing Sector
- Policy Brief No. 25: Emerging Impacts of COVID–19 on the Nigerian Food and Beverage Manufacturing Sector
- Policy Brief No. 26: Emerging Impacts of COVID–19 on the Kenyan Food and Beverage Manufacturing Sector

Policy Events

Due to the Covid-19 pandemic, PARI events in 2020 were primarily held virtually. A selection of key events include:

2 April: Online ZEF Seminar with Willi Kampmann to present findings from his PARI research on the role of farmers' organizations in the agricultural transformation in Africa.

17 June: Online ZEF Seminar with Dr. Carlos Seré, senior fellow at ZEF, who presented his PARI study Investing Sustainably in African Livestock Development: Opportunities and Tradeoffs

26 June: Online FARA seminar on "Transformation of the African Smallholder Farmer – An imperative for Agricultural Growth in Africa**"**

11 August: Symposium on Agricultural mechanization in Africa: Myths, realities and an emerging research agenda at the 2020 AAEA (Agri. and Applied Economics Association) Virtual Meeting

9-11 September PARI team members from the University of Hohenheim presented PARI research findings at the virtual Tropentag 2020.

30 October: Online ZEF Seminar to present the findings of the ZEF-Akademiya2063 study From Potentials to Reality: Transforming Africa's Food Production

5 November: PARI team members from ZEF and Akademiya2063 presented PARI research findings at the 2020 ReSAKSS Conference, hosted by Akademiya2063 in partnership with the African Union Commission (AUC).

18 November: PARI hosted a side-event at the online conference Cultivate Africa on the topic How to boost African food production to increase resilience in times of pandemics. The session discussed how

investments in innovations and related policies should be prioritized to enable Africa to increase food supplies from the use of its own resources and thereby improve the resilience of the African food system against pandemics and other shocks.

9 December: Heike Baumüller (PARI Coordinator) presented and discussed the ZEF-Akademiya2063 study From Potentials to Reality: Transforming Africa's Food Production at a meeting of representatives of German farmers' organisations organised by the Andreas-Hermes Academy.

Social Media Outreach

PARI is using social media, notably Twitter and Facebook, to disseminate key research findings, including through dedicated social media accounts hosted by PARI as well as through accounts hosted by PARI partners. **FARA's communication channels** play a critical role in reaching key African stakeholders. The FARA website attracted 1.5 million visits in 2020. The Twitter account is followed by over 30'000 users while the FARA Facebook page has over 75'000 followers.

In addition, PARI operates its own social media accounts. The **Twitter account @PARI_ZEF** had grown to 2803 by December 2020, up 307 followers compared to December 2019. At the peak, PARI's tweets reached 28,1K Impressions in March (Figure 1) and 764 Page Visitors in December (Figure 2). The study on "From Potentials to Reality: Transforming Africa's Food Production" proved particularly popular. Taken together, Tweets to disseminate the study generated almost 16'000 impressions and 402 engagements in 2020. Examples of successful Tweets are provided in Figure 3. The **Facebook** audience has also been gradually increasing with a total number of 724 followers in 2020.

Figure 1: Monthly impressions of PARI tweets for 2020 (in thousands)

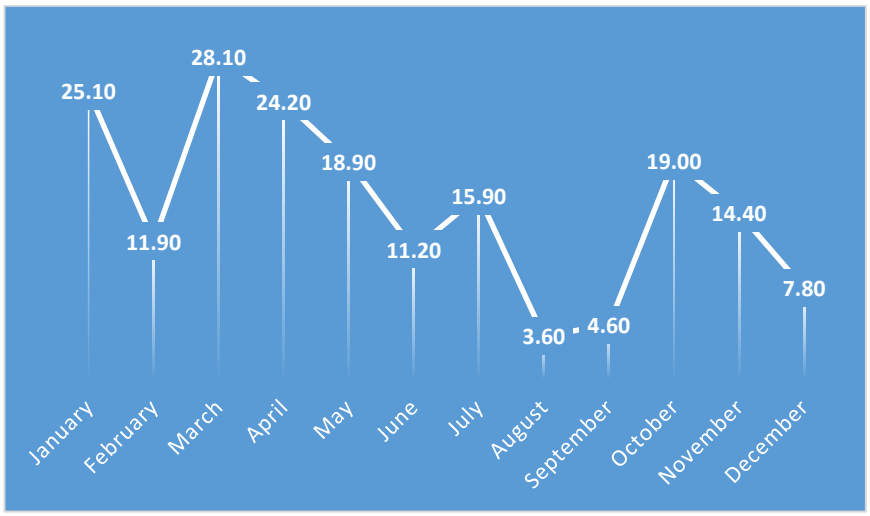

Figure 2: Number of page visits in 2020

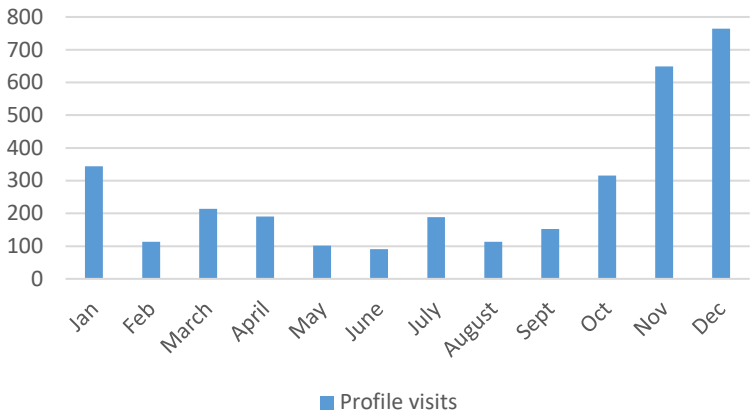

Figure 3: Examples of successful PARI Tweets

Impressions	2,486
Total engagements	100
Media engagements	37
Link clicks	17
Detail expands	15
Likes	13
Retweets	8
Profile clicks	6

Impressions	2,924
Total engagements	63
Media engagements	16
Likes	12
Retweets	10
Link clicks	9
Detail expands	7
Profile clicks	5

Impressions	4,828
Total engagements	97
Likes	36
Media engagements	28
Retweets	22
Detail expands	6

3. Publication List

Publication Title	Partner	Geography
Cross-country studies in Africa		
From Potentials to Reality: Transforming Africa's Food Production	ZEF, A2063	Africa
Strategies for Transforming Smallholder Farming in Africa (book)	FARA	Africa
Investing Sustainably in African Livestock Development: Opportunities and Trade-Offs	ZEF	Africa
Between pandemics and famines: Towards nutrition-sensitive lockdowns during Covid-19 and beyond	UHOH	Benin, Ghana, Kenya, Uganda, Zambia,
'We would rather die from Covid-19 than from hunger´ – Exploring lockdown stringencies in five African countries	UHOH	Benin, Ghana, Kenya, Uganda, Zambia
Characterization of Youth Employment Initiatives in selected African Countries: A synthesis Report	FARA, ZEF, INRAB, PSI, CSIR-STEPRI, DARS, LUANAR	Benin, Ethiopia, Ghana, Malawi
Perceived effects of farm tractors in four African countries, highlighted by participatory impact diagrams (journal publication)	UHO, ZEF, ARCN, INRAB, KALRO, IER, FARA	Benin, Kenya, Mali, Nigeria
Impacts of agricultural mechanization: Evidence from four African countries	UHO, ZEF, ARCN, INRAB, KALRO, IER, FARA	Benin, Kenya, Mali, Nigeria
Mobilizing Investments in Fertilizer Production and Distribution in Ethiopia, Nigeria and Uganda	FARA, ZEF	Ethiopia, Nigeria, Uganda
India-Africa Partnership in Trade and Investment: With focus on the Agriculture and Food Sector	ZEF, ICRIER	India, Africa
Uber for tractors? Opportunities and challenges of digital tools for tractor hire in India and Nigeria	UHOH	India, Nigeria
Copyright or copyleft: An assessment of farmer-innovators' attitudes towards intellectual property rights (journal publication)	ZEF	Kenya, Malawi, Zambia
Targeting Small-Scale Irrigation Investments using Agent-Based Modeling: Case Studies in Mali and Niger	ZEF, AGRODEP	Mali, Niger
Country studies		
Mechanization and Skill Development for Productivity Growth, Employment and Value Addition: Insights from Benin	FARA, UHOH, ZEF, INRAB	Benin
Enhancing youth Employment Opportunities in Rural Economies in Benin	FARA, ZEF, INRAB	Benin
A Review of Youth Employment Initiatives In Benin: Policy Perspectives	FARA, ZEF, INRAB	Benin
Study of Selected Livestock Innovations in Ethiopia	ZEF, ILRI	Ethiopia
Youth aspirations, perceptions of farming, and migration decisions in rural Sub-Saharan Africa: Further empirical evidence from Ethiopia	ZEF	Ethiopia
Enhancing Youth Employment Opportunities in Rural Economies in Ethiopia	FARA, ZEF, PSI	Ethiopia
Enhancement of Employment and Income Opportunities for Rural Youth in Ethiopia: A Review of Four Large Youth Employment Initiatives	FARA, ZEF, PSI	Ethiopia
Employment Potential of the Agro-processing Manufacturing Sector in Ethiopia	FARA, ZEF, PSI	Ethiopia

Publication Title	Partner	Geography
Employment Potential of the Food and Beverage Sector in Ghana	FARA, ZEF, CSIR-STEPRI	Ghana
Status and Readiness for ICTs in Ghana's Agriculture	FARA, ZEF, CSIR-STEPRI	Ghana
A Review of Youth Employment Initiatives in Ghana: Policy Perspective	FARA, ZEF, CSIR-STEPRI	Ghana
Enhancing Youth Employment Opportunities in Rural Economies of Ghana	FARA, ZEF, CSIR-STEPRI	Ghana
Indian farm wages: Trends, growth drivers and linkages with food prices	ZEF, ICRIER	India
Farm Mechanization in Indian Agriculture with Focus on Tractors	ZEF, ICRIER	India
Socioeconomic Perspectives of Jain Irrigation Project in Kibwezi, Kenya	FARA, ZEF, KALRO	Kenya
Mechanization and Skills Development for Productivity Growth, Employment and Value Addition: Insights from KENYA	FARA, UHOH, ZEF, KALRO	Kenya
The Status of ICT Infrastructure, Innovative Environment and ICT4AG Services in Agriculture, Food and Nutrition in Kenya	FARA, ZEF, KALRO	Kenya
Assessment of Youth Employment Initiatives in Malawi: Implementation Realities and Policy Perspective	FARA, ZEF, DARS, LUANAR	Malawi
Mechanization and skills development for productivity growth, employment and value addition: Insights from Mali	FARA, UHOH, ZEF, IER	Mali
Potential and Drivers of Livestock Production in Mali	FARA, ZEF, IER	Mali
Mechanization and Skill Development for Productivity Growth, Employment and Value Addition: Insight from Nigeria	FARA, UHOH, ZEF, ARCN	Nigeria
Digitalization in Agriculture, Food and Nutrition – A Case Study of Nigeria	FARA, ZEF, ARCN	Nigeria
Quantification and benefits of reducing post-harvest losses: Evidence for vegetables in Senegal	ZEF, AGRODEP	Senegal
Using smartphone app collected data to explore the link between mechanization and intra-household allocation of time in Zambia (journal publication)	ZEF, UHOH	Zambia