USAID-FEED THE FUTURE SUSTAINABLE INTENSIFICATION IN AFRICA

MONITORING AND EVALUATION REPORT

(October 2017 – September 2018)

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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The U.S. Government's Global Hunger & Food Security Initiative

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The Africa Research in Sustainable Intensification for the Next Generation (Africa RISING) program comprises three research-for-development projects supported by the United States Agency for International Development as part of the U.S. government's Feed the Future initiative.

Through action research and development partnerships, Africa RISING will create opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program's monitoring, evaluation and impact assessment. http://africa-rising.net/

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

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IITA Research to Nourish Africa

TABLE OF CONTENTS

Acknowledgments

This report was prepared by Beliyou Haile, from the Africa RISING M&E team at IFPRI led by Carlo Azzarri. The report benefited from inputs by Arkadeep Bandyopadhyay (IFPRI), Adam Komarek (IFPRI), Benedict Ebito Boyubie (IITA), Anicet Sambala (IITA), and Jeroen Groot (WUR). The M&E team also acknowledges helpful discussions and inputs from different partners within and outside the program. Ivy Romero provided excellent assistance in various aspects of the planning, management and administration of the M&E project.

Executive Summary

Africa Research in Sustainable Intensification for the Next Generation (Africa RISING--AR) is a research-for-development program designed to pilot potential interventions for sustainable intensification of mixed crop-tree-livestock systems and provide data and information that will lead to the better design of development projects. The program comprises three linked projects covering West Africa (WA: Ghana and Mali), East and Southern Africa (ESA: Malawi, Tanzania and Zambia) and Ethiopian Highlands (EH). The WA and ESA projects are led by the International Institute of Tropical Agriculture (IITA) while the EH project is led by the International Livestock Research Institute (ILRI). The primary hypothesis of AR is that sustainable intensification of mixed crop-tree-livestock systems leads to increased whole farm productivity, which in turn leads to better development outcomes, including improved food and nutrition security. The monitoring and evaluation (M&E) of the three regional projects is led by the International Food Policy Research Institute (IFPRI), with Wageningen University leading farming systems modeling efforts. A communications project is also part of the program, also led by IITA.

During Phase I of the program (2012– 2016), the focus has mostly been on a demand-driven approach to identify scalable entry points for sustainable intensification (SI) of key farming systems across program countries. While most of the analyses during Phase I has been at the household-level, researches have also examined the role of enabling environment for SI including markets, institutions and policies. During Phase II of the program (2017 – 2021), the goal is to reach an estimated 25,000 households for testing alternative SI technologies and management practices. In addition, there will be a significant effort to scale up successful SI options identified in Phase I to over 1 million households, working with development partners and taking advantage of the partnerships and stock of knowledge created in Phase I.

During fiscal year 2017-2018 (FY18, henceforth), monitoring activities undertaken by the team have included: management of program-generated data through Harvard University-managed data repository platform (Dataverse); revision of the program data management plan; aggregation and validation of FtF indicators for FY18; trainings and support to local M&E officers based in Ghana and Tanzania. Research activities undertaken during FY18 include *ex-ante* evaluation of conservation agricultural practices in Zambia (jointly with CIMMYT); analysis of the willingness to pay for improved technologies in Tanzania.

1. Introduction

The primary hypothesis of Africa RISING is that sustainable intensification of mixed crop-tree-livestock systems leads to increased whole farm productivity, which in turn impacts development outcomes (improved welfare) such as improved livelihoods (income, assets, resilience capacity, etc.) and better food and nutrition security for those who depend on these systems. It is further hypothesized that a combination of relevant interventions is more likely to increase whole farm productivity than single interventions.

Phase I of the program (2012-2016), has been focused on diagnostic studies, partnership building, action research, development of multi-stakeholder platforms, and testing of various baskets of innovations for sustainable intensification of core farming system in selected communities.[1] It was anticipated that Phase II (2017-2021) would focus on the scaling up (and out) of successful SI innovations identified during Phase I, in partnership with relevant development partners. This report discusses the main activities undertaken by M&E team during FY18 (Section 2) and outlines activities planned for FY19 (Section 3).

[1] Definition of community varies across country, depending on the local administrative, institutional, and geographical arrangements.

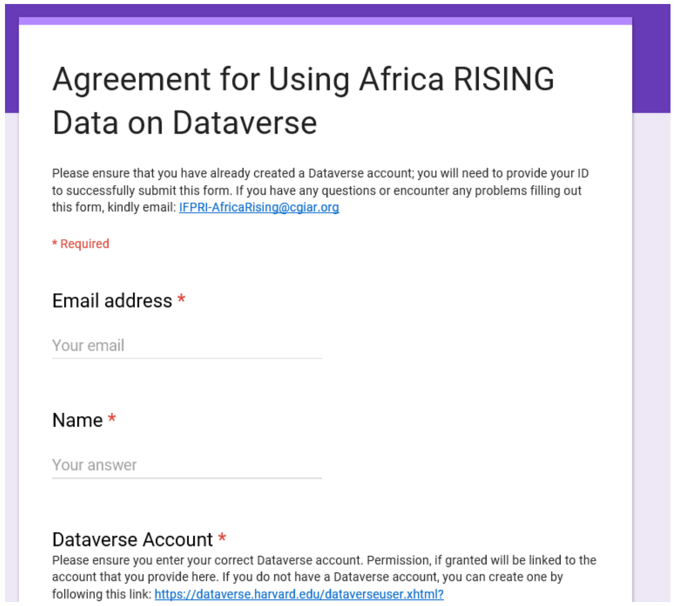
2. M&E and Research Activities Undertaken in Fiscal Year 2018

The following are the main M&E-related activities conducted in Fiscal Year 2018, in addition to various program- and project-level meetings attended by the team members.

2.1. Management of program-generated agro-economic data

The team continued to manage program-generated data through– Dataverse (https://dataverse.harvard.edu/dataverse/AfricaRISING). Since the fall of 2018, data owners[2] started inquiring about the identity of data requestors and intended use of requested data before they grant/deny access. As noted above, not all datasets on Dataverse are currently open, depending on whether they are part of a multiyear experiment or not. Although the identity of data requestors was part of the minimum information data requestors were asked to submit as part of the data request, IFPRI Dataverse administrator was unable to share this information with data owners for privacy reasons. This is because data requestors did not explicitly consent for their identifying information to be shared with data owners. To address this issue, the M&E team and IFPRI's Dataverse administrator implemented a solution whereby all requestors of restricted datasets on Dataverse are now required to sign a web-based Data User Agreement (DUA) form as part of their data request as shown in the screenshot below.

[2] Throughout this document we will refer to data owners (or producers) as researchers who collect data on the field. However, we are aware that this definition neglects the fact that data owners/producers are ultimately the farmers from whom these data are collected. The reason of our definition is because we would like to avoid the confusion between data owners/producers and data providers, since these two groups could be potentially very different: while the former could only collect the data, the latter could only distribute them using different means (media equipment, electronic storage, physical material, online repositories). Of course, the two groups could also be owners and providers at the same time, such as the case of the IFPRI M&E team.



Agreement for Using Africa RISING Data on Dataverse

Please ensure that you have already created a Dataverse account; you will need to provide your ID to successfully submit this form. If you have any questions or encounter any problems filling out this form, kindly email: IFPRI-AfricaRising@cgiar.org

* Required

Email address *

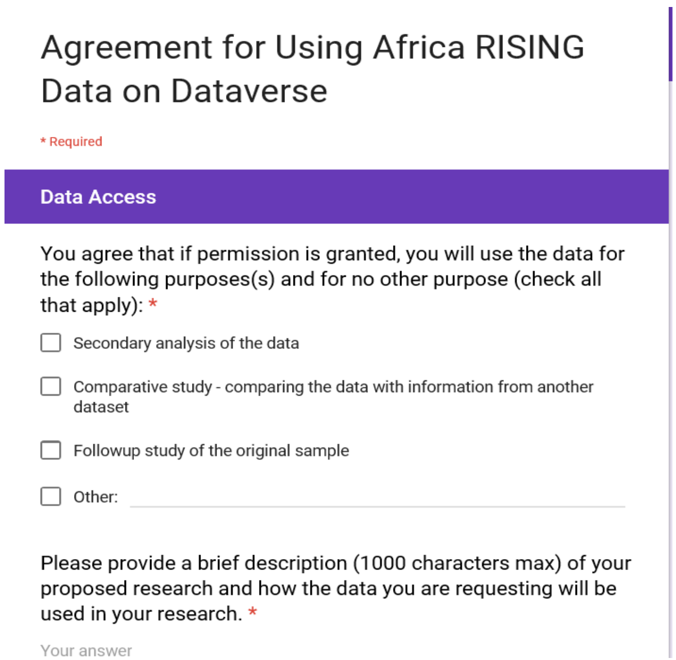
Your email

Name *

Your answer

Dataverse Account *

Please ensure you enter your correct Dataverse account. Permission, if granted will be linked to the account that you provide here. If you do not have a Dataverse account, you can create one by following this link: https://dataverse.harvard.edu/dataverseuser.xhtml?



Agreement for Using Africa RISING Data on Dataverse

* Required

Data Access

You agree that if permission is granted, you will use the data for the following purposes(s) and for no other purpose (check all that apply): *

- [ ] Secondary analysis of the data
- [ ] Comparative study - comparing the data with information from another dataset
- [ ] Followup study of the original sample
- [ ] Other:

Please provide a brief description (1000 characters max) of your proposed research and how the data you are requesting will be used in your research. *

Your answer

The DUA is being implemented through a Google Form and will also record the datasets the requestor would like to access. Given strict privacy regulations, requestor will be given prior notice of the fact that her/his personal information will be shared with data owners, IFPRI Dataverse administrator, and Africa RISING project managers. Additionally, requestor will be alerted that filling out the Google DUA form implies that s/he agrees and abides to the Africa RISING Data Management Plan and privacy policy (see below).

The completed DUA form and request details such as the requested datasets and research purpose will be automatically saved in a Google Sheets spreadsheet for subsequent review by the M&E team, project managers, and data owners. If the data owner approves the request after reviewing the completed DUA, access to the dataset will be granted by the M&E team, and it will be the requestor's responsibility to download the dataset from the website. The spreadsheet will also document cases and reasons of data request denials, if any.

2.2. Monitored data requests through Dataverse

Being a Google product, the Dataverse data request tracker is accessible online to all relevant parties (M&E team, project managers, and data owners). Once a new request is registered on the system, the M&E team is notified and will contact (through email) the relevant data owner about the request. The data owner is then requested to either open the Google Sheet spreadsheet to mark the data access decision, or directly reply to the requestor's email indicating the decision (accept or reject). Having this information on an online spreadsheet allows the M&E team and project managers to be fully informed about the number of requests submitted and to keep track of pending requests. Data owners are reminded periodically of any pending data requests, although they are never responsible for the final assignment of permission on Dataverse, as this feature remains responsibility of the M&E team. Apart from regular record keeping, the Google Sheets spreadsheet also allows to easily create summary tables on the most downloaded datasets, and the countries with greatest interest.

2.3. Revised program Data Management Plan

The program's data management plan (first approved in October 2014) has been revised in May 2018 to reflect updates made to the program data repository platform as well as to address other suggestions from program partners and the new data landscape. Updated data management plan can be accessed here. As part of the revision, additional details were included addressing program-level requirements for data upload on Dataverse, online data requests and their monitoring, and sharing of confidential and non-confidential data within and outside the program.

2.4. Partially populated the beneficiary and technology tracking tool (BTTT)

The team worked with the M&E officer in West Africa to partially populate the beneficiary and technology tracking tool (BTTT) for Ghana. This tool allows researchers and program managers to uniquely link AR innovations to households engaged in testing the innovations (direct beneficiaries), thereby facilitating interoperability of different types of data collected from the same households.

2.5. Aggregated and reported FtF indicators data

Following the changes in indicator reporting outlined in the 2018 FtF Indicator Handbook[3], the M&E team worked with project managers to identify new/modified set of relevant indicators and subsequently collaborated with researchers and local M&E data managers to compile achievement data for FY2018 and set target on the new/modified indicators for 2019-2021 shown below.

2.6. Analysis of the determinants of the willingness to pay for improved technologies

Based on primary data collected from Babati district (Tanzania) and using contingent valuation experiment, the team has been assessing the determinants of the willingness to pay (WTP) for hybrid maize seed and local inorganic fertilizer. Among other things, the study finds that access to improved extension services is positively correlated to farmer WTP, whereas farmer risk aversion preferences are associated with significant and negative parameter estimates for both hybrid maize seed and inorganic fertilizer. Farmers are willing to pay a premium for hybrid maize seed while their interest in fertilizer purchase at current market price seems to be low, consistent with relatively high adoption of hybrid maize but limited application of inorganic fertilizer in the area. Encouraging risk reduction options -such as agricultural insurance- to boosting farmer demand for improved agricultural technologies could be a suitable policy option to promote adoption. A higher-than-market price estimates of WTP for hybrid maize seed suggests the potential for enhanced adoption, while lower-than-market price estimates of WTP for inorganic fertilizer may suggest the need for interventions to reduce the cost of this input including through targeted subsidies. The study has been accepted for publication on *Food Security*.

2.7. Correlates of the adoption of SI innovations

Using primary data from Africa RISING sites in Tanzania, this study examines the correlates and likely determinants of the adoption of six SI practices (SIPs) -improved cultivars, cereal-legume intercropping, crop rotation, organic fertilizer, contour ploughing, and leguminous trees. This study examined adoption rates across different farm types (see below) addressing five SI domains:

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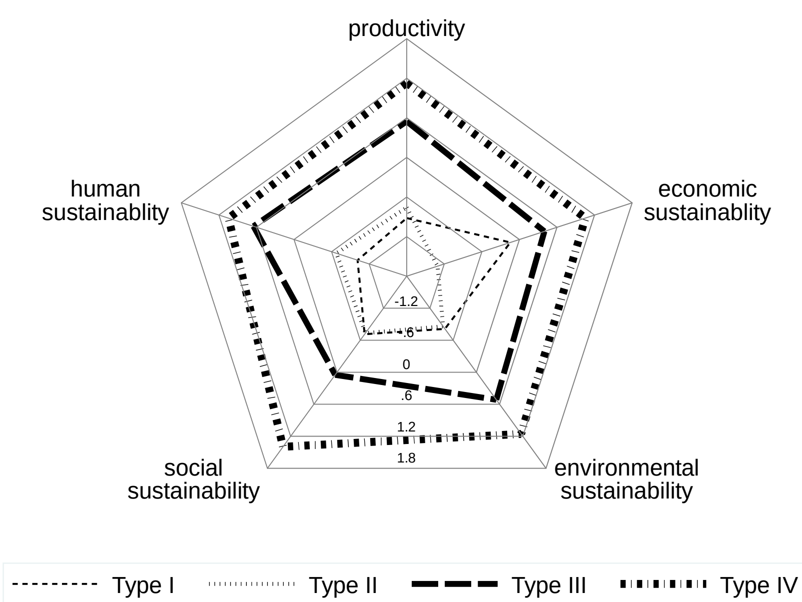
[3] https://www.agrilinks.org/sites/default/files/ftf-indicator-handbook-march-2018-508.pdf

productivity, environmental sustainability, social sustainability, economic sustainability, and human wellbeing. The below table summarizes the four farm types analyzed.

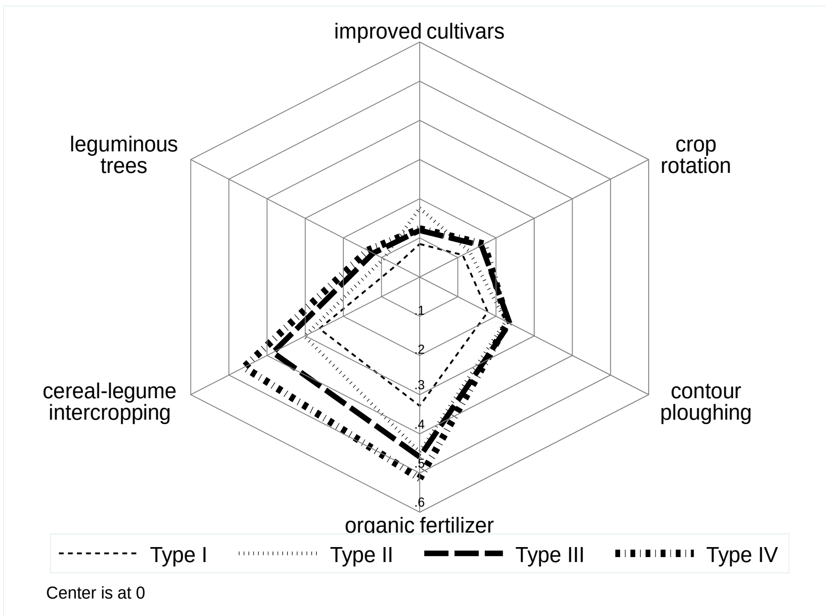
Farm types	*Farm characteristics*
Type I (30 percent)	Low endowment (livestock and education); poor quality dwelling condition; least likely to use communal or hired labor, high share of woman-managed plots; the youngest household heads; least likely to own fertile (clay/loam soil) plots; faces soil erosion; least productive and market-oriented; least food and nutrition secure
Type II (22 percent)	Low endowment (land and livestock); average education; the most access to markets; most likely to use communal or hired labor; own fertile (clay/loam soil) plots; practice intercropping; average productivity; high market orientation; average food and nutrition security
Type III (27 perecent)	Average endowment (land and livestock); low quality dwelling condition; the least educated; low ownership of fertile (clay/loam soil) plots; low productivity, the least access to markets; more likely to be headed by females and older heads; above-average food and nutrition security
Type IV (21 percent)	Highest endowment (land, livestock, and education); better quality dwelling condition; more likely to combine farming with livestock and practice intercropping as well as to purchase improve seeds; highest share of woman-managed livestock; more likely to own fertile (clay/loam soil) plots; the most productive, high market-orientation; the most food and nutrition secure

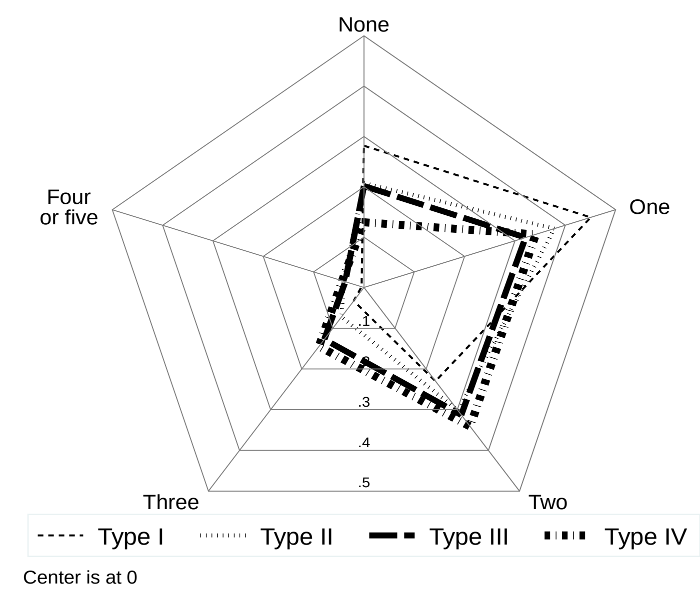
A summary of selected SI indicators by farm types is shown below with farm types I and II performing poorly along the selected dimensions.



Note: productivity is measured by maize yield; economic sustainability by per capita total household consumption expenditure (*proxy* for agricultural income); environmental sustainability by share of parcels with clay/loam soil; social sustainability by membership in farmer research group; human sustainability by household dietary diversity score (based on 12 food groups).

Econometric analysis of the correlates of adoption of individual SIPs as well as adoption intensity -the latter measured by the count of SIPs applied per plot- shows that adoption rates are the highest (lowest) for farm types with the highest (lowest) scores on selected SI indicators. Adoption rate of individuals SIPs as well as intensity of adoption by farm type is shown below. Average household education, access to agricultural extension services, and land ownership are positively correlated with adoption intensity, while soil fertility, homestead–plot travel time, and relatively dry agro-ecologies are all negatively correlated with adoption intensity.





Results from this study have been published as IFPRI Discussion Paper here.

2.8. Ex-ante evaluation of AR technologies

This study combined bottom-up and top-down approaches to examine the *ex-ante* effects of conservation agriculture (CA)-based systems in Zambia, considering both biophysical and economic factors as well as prevailing farming systems characteristics. The bottom-up approach relied on on-farm agronomic trials and household surveys, whereas the top-down approach was based on gridded climate and soil datasets as well as grain yields data sourced from statistical agencies. For continuous maize cropping we compared a CA-based system (no-tillage with crop residue retention) with a control system (conventional tillage with crop residue removal). First, yield effects were simulated, calibrated, and evaluated against multiple datasets, including on-farm agronomic trials. Simulations were then extrapolated to all maize-growing areas in Zambia using gridded climate and soil datasets. Simulated yields were combined with economic data to construct economic indicators including benefit-cost ratios that accounted for system interactions including the implicit value of crop residues and labor demand. The field scale indicators were scaled out to the province scale by multiplying yields, gross benefits, and variable costs by maize harvested area. A spatial farm typology analysis was also conducted to help understand the context-specific factors underlying spatial variation in field-scale indicators and provide insights into potential trade-offs from CA at the farm scale.

Average changes in yield from using CA-based systems (compared with the control) at the district scale ranged from −37% to 70% (average 33%), with a similar range of changes in benefit-cost ratios once economic factors were included, in addition to intra-district variability. Combining the changes in benefit-cost ratios with maize harvested area resulted in an average annual change in district-scale net benefit ranging from US $ −3.9 to 9.9 million (with an average of 1.1 million). The heterogeneity in biophysical and economic conditions yielded a ranking of provinces according to biophysical or economic indicators, reinforcing the importance of coupling biophysical and economic approaches, and adapting CA systems to the specific needs and environments of farmers. This study will be published on *Agricultural Systems* (forthcoming).

2.9. Linkages between production diversity and dietary diversity

The M&E team collaborated with IITA to analyze the role of agricultural production diversification in improving food and nutrition security and enhancing income using data for

Ghana. Results show that households maintained high levels of crop diversity, with up to eight crops grown, with an-average of 3.2 per household, and with less than 5% with a null or very low level of crop diversity. The value of crop harvest used for self-consumption was on average 55% higher than that of crop harvest sold. Crop diversity is positively associated with self-consumption of food crops as well as income from crop sale suggesting that increasing diversification may open market opportunities, while still contributing to household food and nutrition security. Study findings imply that in setting with diversified farming systems, interventions that assess and build on their *de facto* diversity will most likely be successful in tacking undernutrition and poverty. Research study has been published as IFPRI Discussion Paper series here.

2.10. GIS- and typology-based technology recommendation domains

The team continued its collaboration with WUR and IITA to refine and pilot the FarmMATCH approach to facilitate the matching of agricultural technologies with farm- and landscape-level characteristics. Please see concept note here. FarmMATCH contains 1) a learning and matching algorithm that identifies the most suitable and promising technologies for different farm types, and 2) a data mining and signaling algorithm that identifies hotspots of suitability of technologies and potential adopters. The matching algorithm combines contextual, farm and technology characteristics to create a ranking of the suitability and adoption probability of available innovations. The data mining and signaling algorithm monitors the generated technology rankings and recommendations made to farmers. When the frequency of recommendations for a particular technology strongly increases in space or in time FarmMATCH issues a signal that a hotspot has been identified. In turn, this identification triggers spatially-tailored policy analysis, such as additional incentives and interventions to provide innovation support to enhance information exchange among farmers; supply chain development; availability of financial arrangements.

2.11. Staffing in FY 2018

Following the departure of the IFPRI M&E officers in both WA and ESA in 2017, M&E coordinators/data managers have been hired by IITA for each regional project using funds that were reallocated from IFPRI to IITA. Similar transfers were also made to ILRI to allow the hiring of an M&E coordinator/data manager for Ethiopian Highlands but the position has yet to be filled. The core IFPRI M&E team also had a turnover in Research Analyst position in 2017.

3. M&E and Research Activities Planned for Fiscal Year 2019 (FY19)

3.1 Management of program-generated agro-economic data

The team will continue managing program-generated data through Dataverse. Taking advantage of the new Google-based system for monitoring data requests and with the support of the M&E officers/data managers, the team will help facilitate a more efficient tracking of data requests. As currently restricted AR datasets become open, the team will link them to USAID's Development Data Library (DDL). According to the program Data Management Plan, datasets uploaded on Dataverse that are part of a multiyear experiment will remain restricted until the experiment comes to an end. Therefore, only open datasets will be linked to the USAID-DDL.

3.2 Documentation of AR innovations and beneficiaries

The M&E team will continue supporting local M&E officers to ensure continuous compilation of data about AR innovations and beneficiaries. For households engaged in testing innovations (direct beneficiaries), this objective will be achieved through the beneficiary and technology tracking tool (BTTT). Data on indirect beneficiaries and beneficiaries of scaling activities will also be compiled by M&E officers using the scaling and exposure tools developed by the IFPRI team. For WA, the team has identified a Malian research and survey firm that will be assisting the Ghana-based non-French speaker AR M&E officer with this task.

3.3 Aggregation and reporting of FY 2019 FtF indicators data

The team will also support AR researchers and local M&E officers to ensure timely submission of consistent and disaggregated FtF data for FY 2019 for the following indicators for which targets have been set during FY 2018 reporting period.

- EG.3.2-25 Number of hectares under improved management practices or technologies with USG assistance [IM-level]
- EG.3.2-24 Number of individuals in the agriculture system who have applied improved management practices or technologies with USG assistance [IM-level],
- EG.3.2-2 Number of individuals who have received USG-supported degree-granting non-nutrition-related food security training [IM-level]
- HL.9-4 Number of individuals receiving nutrition-related professional training through USG-supported programs [IM-level]

- EG.3.2-7. Number of technologies, practices, and approaches under various phases of research, development, and uptake as a result of USG assistance [IM-level]

Data submitted by individual researchers will subsequently be aggregated and uploaded onto the Feed the Future Monitoring System (FtFMS).

3.4 Trainings

Working with local M&E coordinators/data managers, additional in-country trainings will be conducted on project monitoring, evaluation, and data management. Training will be delivered both in classrooms and during site visits by the M&E coordinators/data managers. One training attended by AR researchers from all target countries was conducted on October 29, 2017. This training addressed topics including various data needs for project monitoring, online and offline monitoring and data management tools, and data management in Dataverse,

3.5 Implementation of a follow-up survey

The M&E will continue the ground work to implement Africa RISING Follow-up Evaluation Survey (ARFES) in FY19 in Malawi. Since baseline survey collected in summer 2013, the team has been liaising with Malawi researchers to update beneficiary database to inform follow-up survey design. Follow-up data will allow the team to analyze effects on medium- to long-term economic and development outcomes using panel data techniques.

3.6 GIS- and typology-based technology recommendation domains

Through its collaboration with IITA and WUR researchers, the M&E will contribute to the development of typology-based technology recommendation domains. In FY 2019, the research team plans to test the algorithm developed on a limited number of GIS grid cells in Babati district of Tanzania. Given that farmers surveyed as part of IFPRI's baseline survey will be present in each grid cell, their associated characteristics will be used to train and test the algorithm for identifying the most suitable and promising technologies for different farm types residing in diverse agroecological zones. This research will be expanded to other AR target countries.

3.7 Analyses of enabling conditions for improving resilience to weather variability

The team plans to undertake a cross-country analysis of enabling conditions for enhanced resilience at the household scale (diversity/redundancy, reserves/buffer stocks, modularity, feedbacks) using cross-sectional data collected from FtF Zones of Influence. However, given that the analysis will be based on cross-sectional data, resilience analysis will be limited. Nonetheless, the study is expected to identify potential entry points to enhance household resilience drawing upon the rural livelihood literature on the five capital assets and how they can shape livelihoods within the farm household vulnerability context. This analysis will be complemented with farm household typologies where households are categorized into different groups based on observable characteristics that could promote resilience including income, farm production, and food security as well as contextual factors such as climate variability and price shocks. Different household types will be identified based on their resilience capacity.

3.8 Ex-ante evaluation of promising innovations

The M&E team expects to progress on a collaboration with West Africa and Ethiopian Highlands researchers for a collaborative research on ex-ante evaluation of promising Africa RISING technologies. The research will follow a similar approach to the one used for evaluating CA-based technologies in Zambia (Komarek et al. 2018). The evidence to be generated will allow researchers -and program managers alike- to better understand the *ex-ante* implications of farmers taking up promising practices in terms of, for example, farmer production (yields or nutrients), income, labor balances (supply versus demand), cash flow, benefit cost ratios, input costs, and income variability. Farming systems and typology analyses will be conducted combining data from agronomic field trials, household surveys, and gridded biophysical variables to identify household *ex-ante* suitability to specific technologies and examine effects on a range of indicators should technologies be adopted by farmers in target countries. Research topics will be prioritized based on availability and extent of crop management data from agronomic trials, such as cultivars used, planting and harvesting dates and planting densities, rotation/intercropping details (monocrop, intercrop, or rotation); fertilizer application rates and dates and fertilizer names; grain yield and biomass; herbicide and pesticide applications; and labor requirements disaggregated by agronomic practice/technology.

3.9 Sustainable agricultural practices and resilience to weather variability

Similarly, the team will plan to collaborate with Malawi AR and MSU researchers on a research on the role of sustainable agricultural practices (SAPs) in improving resilience to weather variability. SAPs embed the potential to reduce risks in cropping systems related to climate shocks as they are expected to improve soil quality, water storage and infiltration, and soil moisture

(Hobbs et al., 2008), thereby creating a buffer for water stress in the event of a climate shock. Reviews of theoretical and empirical studies have shown that resource-poor farmers are often risk averse, limiting their dichotomous decision to use a technology and/or the intensity of the technology's use (Feder et al., 1985). SAPs have been shown to help increasing yields (Pretty, 2008; Pretty and Bharucha, 2014), but they often entails tradeoffs, with their adoption usually constrained by the complexity of their use embedded in composite systems (Giller et al., 2008; Giller et al., 2011). Varying profitability of technologies and diverse farm management needs have long been known as reasons for relatively low incidence in agricultural technology adoption (Griliches, 1957; Mundlak, 1961).

In light of current and expected climate variability (Thornton et al., 2014), a growing emphasis on the need for reducing vulnerability of cropping systems to climate variability and for understanding the role of different SAPs in improving the state and functioning of cropping systems has emerged. While a large body of theoretical literature on resilience related to agricultural systems exists (Robinson et al., 2015; Tendall et al., 2015; Tittonell, 2014 among others), numerous calls emphasize the need for more empirical studies on how to increase resilience in agricultural and food systems (Fan, 2014; Robertson et al., 2008). Our research will focus on maize-based system in Malawi, combining agricultural trials panel data collected by Malawi researchers with time series of climate data, eventually matched with the IFPRI baseline and follow-up evaluation household and community surveys.

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