USAID-FEED THE FUTURE SUSTAINABLE INTENSIFICATION IN AFRICA

MONITORING AND EVALUATION REPORT

(October 2016 – September 2017)

February 8, 2018

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/

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Acknowledgments

This report was prepared by the Africa RISING M&E team at IFPRI, led by Dr. Carlo Azzarri. The report benefited from inputs from Beliyou Haile (Global M&E coordinator), Ho-Young (IFPRI), Adam Komarek (IFPRI), Jeroen Groot (WUR), and Jawoo Koo (IFPRI) as well as former M&E team members Apurba Shee (East Africa M&E coordinator), Moussa Sankara (West Africa M&E coordinator), and Gebrehiwot Hailemariam (Ethiopia M&E coordinator). 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, led by ILRI.

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 the course of fiscal year 2016-2017 (FY17, henceforth), monitoring activities undertaken by the team have included the migration of Africa RISING data from the old data repository (CKAN) to the new one (Dataverse), updates to the Project Mapping and Monitoring Tool (PMMT), aggregation and validation of FtF indicators for FY17, in-country trainings on project monitoring (Ghana and Mali), and development of monitoring tools. Research activities undertaken during FY17 include updates to farm household typologies (joint with WUR), analysis of the likely correlates of the adoption of SI technologies (Tanzania), *ex-ante* evaluation of conservation agricultural practices in Zambia (jointly with CIMMYT), analysis of the nexus between production diversity and dietary quality in Ghana (jointly with IITA); trade-

offs in farming systems (Malawi) and analysis of the willingness to pay for improved technologies (Tanzania). Due to unforeseen budget uncertainty arisen in mid-2017, the M&E team was forced to revise some of the planned activities, including the implementation of follow-up evaluation household and community surveys.

For FY 2017-2018 and beyond, the program might change country focus, since three of the program countries in Phase I (Malawi, Tanzania, and Zambia) are no longer the focus of the FtF under the newly approved USAID Global Food Security Strategy (2017-2021). The M&E team, in collaboration with other AR partners, is currently exploring other funding opportunities to continue and finalize activities initiated during Phase I.

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 leads to development outcomes (improved welfare) such as improved livelihoods (income, assets, 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.

During Phase I of the program (2012-2016), the focus has been on diagnostic studies, partnership building, action research, development of multi-stakeholder platforms, and testing of various baskets of innovations for the 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 FY17and outlines activities planned for FY18 (in section 2 and 3, respectively). Section 4 concludes the report.

[1] Definition of community varies among countries, depending on the local administrative and geographical arrangements.

2. M&E activities in Fiscal Year 2017

The main M&E activities undertaken in FY17 are summarized below.

2.1. Updates to the Project Mapping and Monitoring Tool (PMMT)

Another round of updates has been made to the data entry application of the Africa RISING Project Mapping and Monitoring Tool (PMMT). The PMMT has been developed to aid project monitoring efforts within and outside the program and has been intended to help users (project managers, donors, researchers, data analysts, and stakeholders in general) better understand where and how program activities are taking place. The tool has the following applications:

- **Data entry application** which allows users with the appropriate credentials to add project-related data (e.g., FtF indicators as well as customs indicators) to the PMMT through an intuitive, step-by-step web interface
- **Mapping application** which allows users to contextualize where Africa RISING research activities are taking place and provide them the opportunity to view and overlay various socio-economic, biophysical, and agriculture-related data

The following are the main updates made to the PMMT in FY17.

- Addition of new indicators to the database (e.g., as part of the Integrating Nutrition in Value Chains (INVC) and Bridging activity in Malawi and other custom indicators for West Africa)
- Customization of the data entry fields to allow the reporting of additional indicators of interest.
- Addition of new sites to the database as part of the expansion of Africa RISING activities in Malawi (in Dedza, Ntcheu, Machinga, and Mangochi districts)
- Update of site types to reflect the different types of action sites
- Implementation of user interface modifications to enable column hiding and scrolling (to make the tool user friendly)

2.2. Aggregation of the 2017 FtF indicators data

The M&E team has aggregated Feed the Future (FtF) Indicators data submitted by program researchers using the updated features of the PMMT. Data submitted by individual research teams were validated and aggregated at mega-site level, along with the discrepancy narrative whenever the gap between target and

actual achievement was more than 10 percent. The team subsequently uploaded and submitted aggregated data onto USAID's FTF Monitoring System (FtFMS) portal.

2.3. Migration of program generated data to the new platform

The team oversaw and finalized the migration of Africa RISING datasets from the original data repository platform managed by ILRI (known as Comprehensive Knowledge Archive Network -CKAN) to the new platform managed by IFPRI (known as Dataverse). Per agreement with ILRI, the associated meta-data will remain on CKAN with hyperlinks to the raw data on Dataverse and ILRI-owned datasets will remain on CKAN with associated meta-data linked to Dataverse.

Africa RISING page on Dataverse can be accessed here:

https://dataverse.harvard.edu/dataverse.xhtml?alias=AfricaRISING

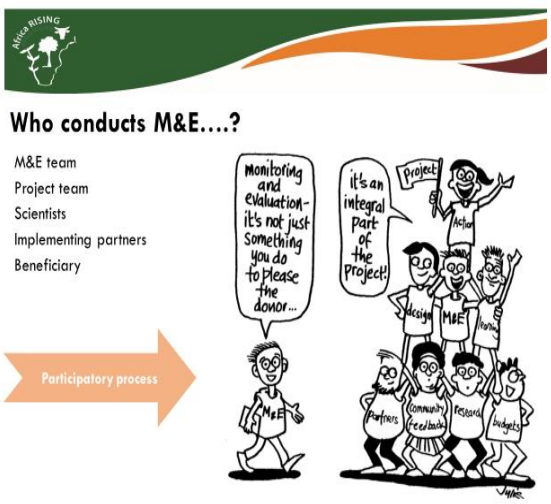
The corresponding how-to user guide can be accessed here:

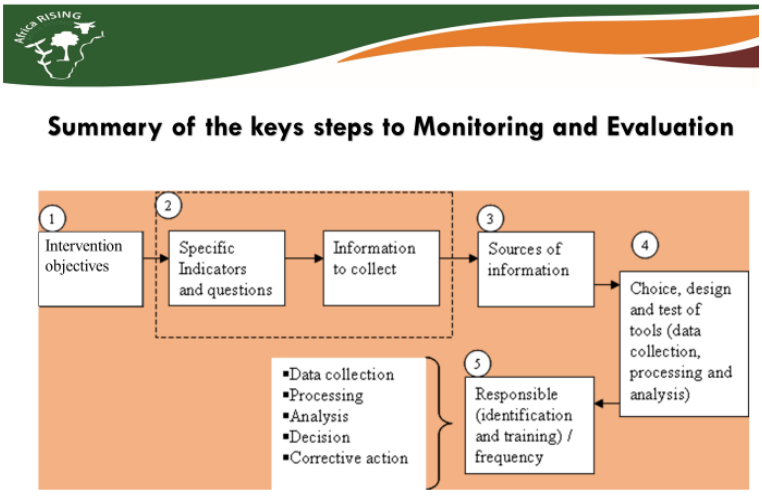
https://africa-rising.wikispaces.com/file/detail/Dataverse_Guide_August2017.pdf

As of February 2018, the M&E is working with USAID's Development Data Library (DDL) team to link Africa RISING's page on Dataverse with the DDL.

2.4. In-country trainings on project monitoring and data management

In country trainings on project monitoring and data management were conducted in Ghana and Mali by the local M&E coordinator. In addition to providing a refresher on the PMMT and reporting of FtF indicators data, the training created an excellent opportunity for in-depth discussion about the data collection responsibilities and supporting tools.





2.5. Updates to the monitoring data requirement guide and supporting tools

With input from AR researchers and local M&E coordinators, the M&E team has updated the monitoring data requirement guide and supporting tools, including the Beneficiary and Technology Tracking Tool (BTTT). The BTTT was developed to allow partners to track program beneficiaries and technologies using unique household identifiers. The deployment of the BTTT in the field has been postponed in light of the uncertainty around project funding and the subsequent departure of all the three local M&E coordinators.

2.6. Africa RISING follow-up evaluation surveys (ARMES)

The M&E team has developed household and community survey tools for Malawi Africa RISING Mid-line Evaluation Survey (ARMES), although implementation has also been postponed.

2.7. Research and outreach

The following research studies were conducted/finalized in FY17.

2.7.1. *Ex-ante* evaluation of conservation agricultural practices (Zambia)

Jointly with CIMMYT researchers, the team analyzed experimental data on conservation agricultural practices (CA) as well as secondary socioeconomic data from Zambia as part of its ongoing efforts in *ex-ante* evaluation of AR technologies. The study adopted a process-based cropping system model called Decision Support System for Agrotechnology Transfer (DSSAT) (Jones et al., 2003). DSSAT includes a suite of modules for simulating crop growth and yield as a function of soil water and nutrient dynamics, weather conditions, and farmers' management practices on a daily time-step. The Zambia study sites and their characteristics are summarized in the table below.

2014-2015 growing season (Oct to May)

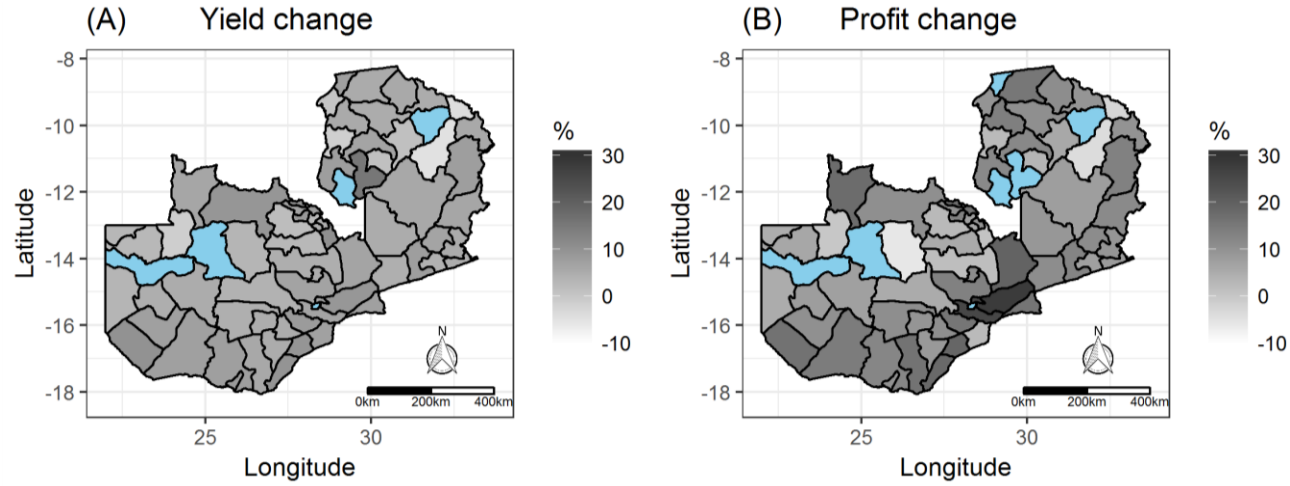
Site	# of data	Variety	Planting Month	Harvesting Month	Precipitation	Average grain yield	Average biomass yield
					mm	kg	dry matter ha^{-1}
Chanje	8	SC627	Jan	June	561	2126	4328
Hoya	8	PAN53	Dec	May	713	2323	2052
Kapara	4	DKC8053	Dec	June	392	2419	806
Kawalala	8	PHB30G19	Dec	May	611	2549	4695
Mtaya	8	DKC8033	Dec	May	769	1455	2446
Vuu	6	PHB30G19	Dec	May	955	3588	2284

2015-2016 growing season (Oct to May)

Site		Variety	Planting Month	Harvesting Month	Precipitation	Average grain yield	Average biomass yield
					mm	kg dry matter ha^{-1}	
Chanje	8	SC627	Jan	May	513	1835	3098
Hoya	8	PAN53	Dec	May	664	3282	3521
Kapara	4	DKC8053	Dec	May	402	2540	3208
Kawalala	8	PHB30G19	Dec	May	599	3269	3053
Mtaya	8	DKC8033	Dec	May	411	1357	2435
Vuu	6	PHB30G19	Dec	April	791	5284	5654

Based on results from DSSAT model calibration and validation, best performing CA options have been identified for potential scaling to current maize-producing areas. The figures below show the

percentage change in DSSAT simulated yield (Panel A) and profit (Panel B) between "no tillage with crop residue retention" and "conventional tillage with crop residue removal" for maize monoculture areas.



Preliminary analysis has also been conducted on expected agroeconomic gains from a large-scale adoption of the technologies. Analysis to be finalized in FY18 upon receiving input price data from Zambia crop forecast survey (currently being facilitated by CIMMYT colleagues based in Zambia). Abstract based on this research study has been submitted to the 2018 Agricultural & Applied Economics Association (AAEA) conference.

2.7.2. Identification of household typologies for technology targeting (cross-country)

In collaboration with WUR researchers, the team developed a statistical methodology for identifying the most important socioeconomic and environmental variables that determine the clustering of farms into different farm types already identified based on baseline data collected by IFPRI. The methodology for assigning prospective farms to existing AR farm typologies involves the following main steps:

- Identification of 10-15 most discriminating variables across the five SI domains through a redundancy analysis (RDA)
- Collection of microdata on these discriminating variables for the new farms
- Calculation of the probability of each farm household belonging to each farm typology through naïve Bayesian (NB) classification
- Assignment of farms to the farm type that corresponds with the highest probability.

Results from this research were shared with AR researchers in East Africa during the ESA Project Review and Planning Meeting in Zanzibar (11 - 15 September 2017). The tables below show a comparative summary of the variables selected for assigning new farms to AR statistical typologies for Ghana (GHA), Malawi (MWI), and Tanzania (TZA).

Variables selected for the NB classification

	GHA n=14	MWI n=15	TZA n=17
Productivity	land_size	land_size	
		livestock_mixed	livestock_mixed
	TLU_bigrum	TLU_chicken	kg_fert
			mean_distance
			yield_cereals
Economic	Agri_male_pd	Agri_male_pd	
		nonagwealth	nonagwealth
	tot_fert_c	floor_good	comm_labour
	HV_tot_sales	hired_labour	tot_impsd_c
		HV_tot_grain	
Social	hh_female	hh_female	hh_female
	fem_lvstresp	fem_lvstresp	
	wage_gap	wage_gap	
	agwealth		agwealth
	fem_plotresp		
Human	hh_age	hh_age	
		males_adults	males_adults
		mean_edu	mean_edu
	females_adults	hh_married	females_adults
	months_fshortage		months_fshortage
	worry_fshortage		worry_fshortage
			hh_lit
			mean_age
Environmental			manure

Note: See the table below for variable definition.

The definition of variables chosen for farm typology identification is given below. As can be seen from the selected indicators from the RDA were nicely distributed over four of the five SI domains (productivity, economic, social, and human), with only the environment dimension

underrepresented. The correct allocations of farm households were 82-89% of the test set, which is a reasonably good percentage.

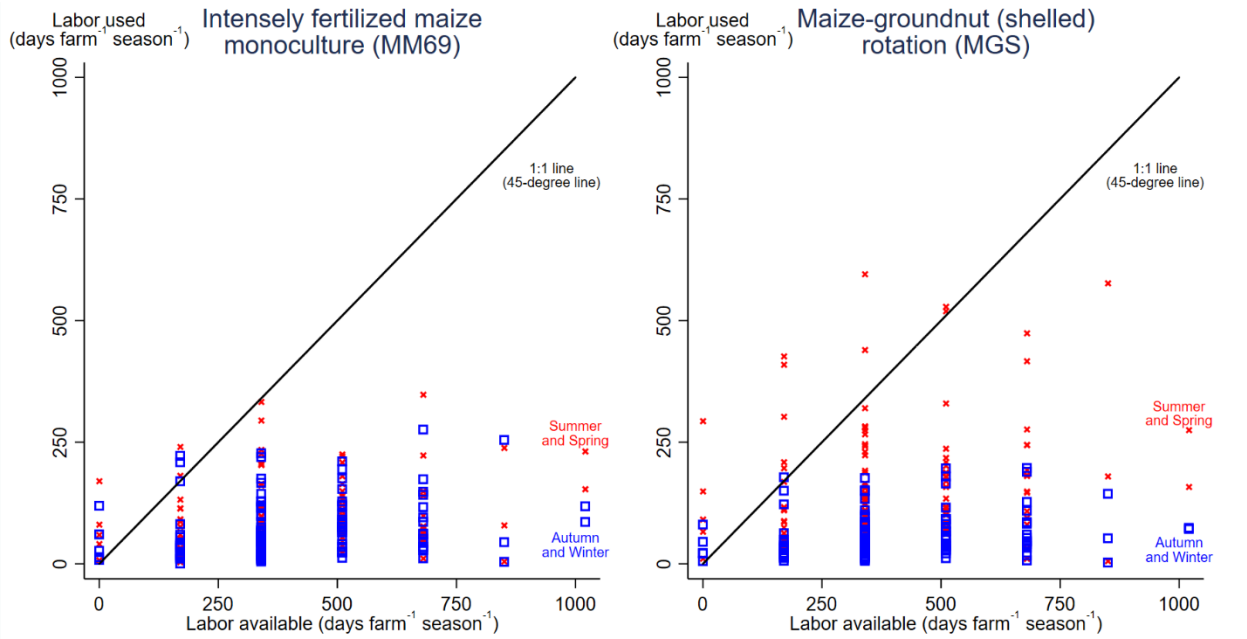
variable name	*variale definition*
land_size	Total land size (Ha)
mean_distance	Mean distance from the plots
ncrops	# of crops per plot
ha_intercrop	Intercropped area at hh (ha)
yield_maize	Yield of maize(kg/ha)
yield_yam	Yield of yam(kg/ha)
TLU_smallrum	TLU--small ruminants
TLU_bigrum	TLU--large ruminants
kg_fert	Chemical fertilizer--kg
tot_fert_c	Value of fertilizer used (LCU)
tot_pest_c	Value of pesticides used (LCU)
Agri_male_pd	Total person-days used, male
Agri_female_pd	Total person-days used, female
Lvst_ld_family	Days of family labor used for livestock management
HV_tot_sales	Total Kg harvest sold
agwealth	Agricultural wealth index
nonagwealth	Non-agr. wealth index
soileros	% of hh affected by soil erosion
soileros_nomeasure	% of hh w/ soil erosion but no erosion control measure
irr_hh	The household uses irrigation
fallowing	% of hhs practicing fallowing
alttillage	% of hhs practicing alternative tillage
n_trees	number of trees owned
kg_urea	Kg of urea used
fem_plotresp	Share of plots partly under female responsibility
fem_lvstresp	Share of livestock partly under female responsibility
wage_gap	Male-female wage gap
high_edu_f	Max females years of education in the household
TLU_chicken	Tropical Livestock Units:chicken
hhsize	Household size
hh_female	Head==female
hh_married	Head=married/cohabiting
hh_age	Age of the head
hh_edu	Years of education of the head
mean_age	Average age in the household
males_adults	Number of males adults in the household
females_adults	Number of females adults in the household
children	Number of children in the household
worry_fshortage	Did you worry about food shortage over the past week?
months_fshortage	How many months over the past year did you experience food shortage?

2.7.3. Socio-economic trade-offs and synergies in cropping systems (Malawi)

This study explored the economic, risk, and labor implications of different legume and mineral fertilizer practices in maize-based cropping systems in central Malawi. It is known that land degradation, population growth, and chronic poverty pose significant threats to the sustainability

of livelihoods for smallholder farmers. Farmers often manage depleted soils, use limited mineral fertilizer, and make decisions about their cropping systems involving multiple trade-offs. For example, while the rotation of cereals with legumes bears agronomic and ecological merit, the socio-economic implications of the cereal-legume rotation require a deeper understanding. Our study combines socio-economic analysis with crop modelling, the latter used to simulate the yield effects of integrating legumes into maize monocultures and applying mineral fertilizer over multiple seasons.

Compared with maize monoculture that used more mineral fertilizer than in the rotation, maize-groundnut rotation is found to increase the average economic profits by 75%. The latter system is also found to increase the stability of profits, reduce the likelihood losses, and increase the risk-adjusted profits. On the other hand, the system is associated with lower caloric yield (54%) and higher labor demand than the maize monoculture with fertilization as shown below.

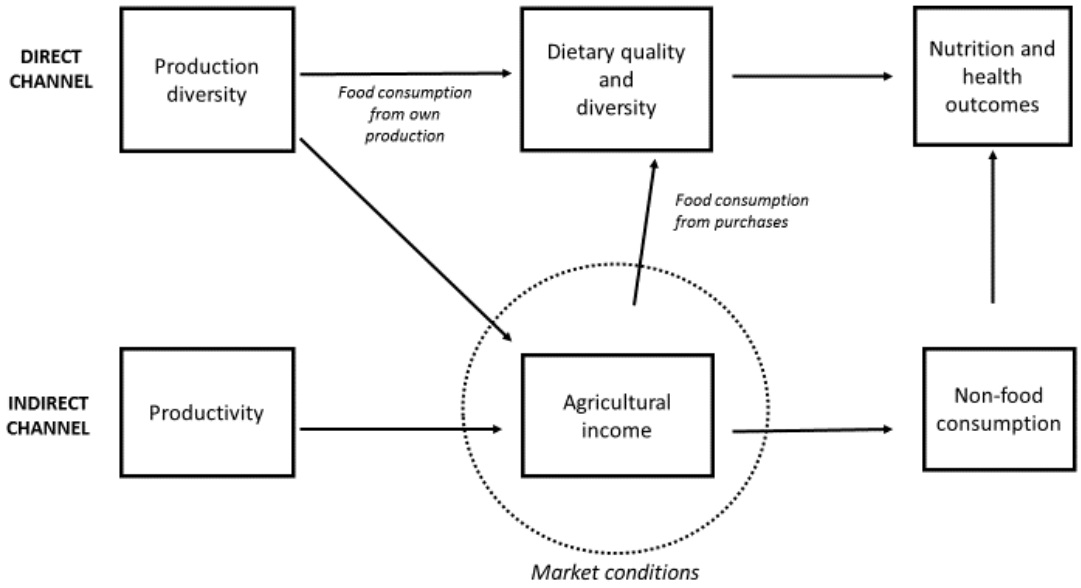


Note: Intensely fertilized maize monoculture (MM69) has 69 kg [N] ha^{-1} of urea applied. The maize groundnut rotation (MGS) has 35 kg [N] ha^{-1} of urea applied to maize and 12 kg [N] ha^{-1} of urea applied to groundnut. N represents nitrogen.

The study has demonstrated that risk and labor factors can be important factors behind the relatively low adoption of some promising technologies with apparently higher agronomic profits, highlighting the trade-offs among alternative cropping systems. An article based on this study is currently under review at a peer reviewed journal.

2.7.4. Assessing linkages between agriculture, nutrition, and markets

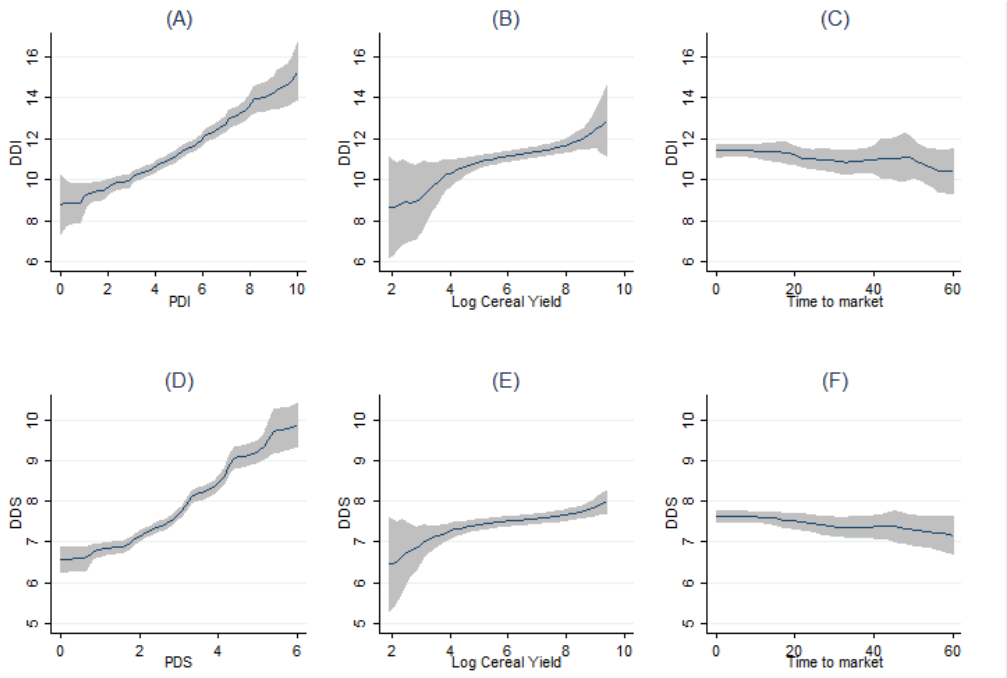
As shown below, dietary quality is determined by several factors.



Source: Adapted from Herforth and Harris (2014).

This study has examined the effects of on-farm production diversity and productivity on household dietary diversity using primary data from Ghana and, in addition, examines possible heterogeneity in the effect of production diversity by market access. Despite progresses made over the last few decades, undernutrition is widespread across Africa south of the Sahara. While agricultural interventions have traditionally focused on enhancing yields of few staple crops, there is increased interest on the role of production diversity in enhancing the dietary quality of subsistence farm households. Econometric results show that both productivity and production diversity positively affect dietary diversity (see figures below).

Linkages between dietary diversity, production diversity, and market access



Note: DDI refers to household dietary diversity index (measured by a simple count of the unique number of food items consumed within the household), DDS refers to household dietary diversity score (measured by a count of unique food groups[2] consumed in the household (ranging from 1 to 12)), time to market is measured by travel time to the nearest daily market using the usual mode of transportation.

As summarized, we also find that the effect of production diversity on dietary diversity gets stronger the farther away the daily market is, consistent with the hypothesis that the reliance on own-produced foods increases with the distance to markets (see below). These results suggest the importance of production diversity in settings with limited access to markets. Results from this study have been published as an IFPRI Discussion Paper.[3]

[2] The following 12 food groups are considered in our household dietary diversity score: cereals; white tubers and roots; legumes, nuts, and seeds; vegetables; fruits; meat; eggs; fish and fish products; milk and milk products; sweets and sugars; oils and fats; and spices and beverages.

[3] https://www.ifpri.org/publication/exploring-agriculture-nutrition-linkage-northern-ghana

	Dietary Diversity Index			Dietary Diversity Score (1-12)		
	2SLS	IV GMM	POISSON IV GMM	2SLS	IV GMM	POISSON IV GMM
Production Diversity Index/ Production Diversity Score	1.154***	1.131***	0.094***	0.679*	0.670*	0.088*
	(0.388)	(0.375)	(0.036)	(0.366)	(0.366)	(0.050)
Production Diversity * Travel time to closest daily	0.030**	0.027**	0.002**	0.019*	0.018*	0.002
	(0.012)	(0.012)	(0.001)	(0.011)	(0.011)	(0.002)
Log of cereal yield (ton/ha)	3.111***	3.306***	0.361***	1.130**	1.068**	0.157**
	(0.909)	(0.876)	(0.110)	(0.458)	(0.433)	(0.068)
Time to the closest daily market (minutes)	-0.166***	-0.151***	-0.014**	-0.063**	-0.059**	-0.008*
	(0.060)	(0.056)	(0.006)	(0.028)	(0.028)	(0.004)
Africa RISING participation	-0.121	-0.143	-0.000	-0.071	-0.094	-0.010
	(0.301)	(0.300)	(0.029)	(0.155)	(0.154)	(0.021)
Household size	-0.308***	-0.303***	-0.028***	-0.123***	-0.114***	-0.015***
	(0.087)	(0.086)	(0.008)	(0.038)	(0.036)	(0.005)
The head is female	1.893***	1.877***	0.153***	0.811***	0.790***	0.106***
	(0.454)	(0.423)	(0.042)	(0.226)	(0.225)	(0.030)
The head is Christian	0.164	0.192	0.035	0.269*	0.300**	0.046**
	(0.478)	(0.468)	(0.043)	(0.146)	(0.143)	(0.020)
The head is Muslim	0.090	0.061	0.024	0.358*	0.394**	0.061**
	(0.542)	(0.540)	(0.053)	(0.202)	(0.195)	(0.028)
Number of females in the household excluding head	0.254**	0.225*	0.015	0.109*	0.096	0.011
	(0.126)	(0.120)	(0.012)	(0.062)	(0.059)	(0.008)
Number of children in the household	0.388**	0.399**	0.036**	0.118	0.119*	0.016*
	(0.166)	(0.165)	(0.017)	(0.075)	(0.068)	(0.009)
Age of the head (years)	-0.013	-0.012	-0.001	-0.011***	-0.010***	-0.002***
	(0.011)	(0.010)	(0.001)	(0.004)	(0.004)	(0.001)
Max. males years of education in the household	0.048*	0.053**	0.005**	0.003	0.007	0.001
	(0.026)	(0.025)	(0.002)	(0.014)	(0.013)	(0.002)
Max. females years of education in the household	0.078***	0.075***	0.008**	0.030**	0.027*	0.004*
	(0.029)	(0.028)	(0.003)	(0.015)	(0.014)	(0.002)
Share of food consumption from own production	-0.038***	-0.039***	-0.004***	-0.010**	-0.010**	-0.001**
	(0.010)	(0.010)	(0.001)	(0.005)	(0.005)	(0.001)
Total land size (ha)	0.082	0.078	0.011	0.110***	0.107***	0.014***
	(0.092)	(0.092)	(0.008)	(0.038)	(0.038)	(0.005)
Non-agricultural wealth (index)	0.383*	0.338	0.009	0.259***	0.238**	0.026**
	(0.232)	(0.226)	(0.024)	(0.098)	(0.097)	(0.013)
Number of off-farm income sources	0.349*	0.346*	0.030	0.159	0.172*	0.021
	(0.194)	(0.193)	(0.019)	(0.099)	(0.098)	(0.013)
Upper East region	-0.604	-0.457	-0.037	-0.399	-0.312	-0.038
	(0.788)	(0.733)	(0.070)	(0.356)	(0.347)	(0.054)
Upper West region	-1.287**	-1.111**	-0.061	-0.280	-0.176	-0.012
	(0.545)	(0.492)	(0.051)	(0.249)	(0.233)	(0.033)
Constant	-10.881*	-12.110**	-0.129	-0.319	-0.124	0.897**
	(5.598)	(5.377)	(0.703)	(2.873)	(2.783)	(0.441)
Observations	1,222	1,222	1,222	1,222	1,222	1,222
R2	-0.083	-0.111		0.110	0.133	
R2 - uncentered	0.880	0.877		0.944	0.945	
Hausman endogeneity test	11.201	11.201		5.746	5.746	
Hausman P-value	0.011	0.011		0.125	0.125	
Kleibergen-Paap rk LM statistic	20.146	20.146		20.849	20.849	
Kleibergen-Paap P-value	0.000	0.000		0.000	0.000	
Sargan-Hansen overidentification test	0.725	0.725	1.148	1.417	1.417	1.657
Sargan's P-value	0.696	0.696	0.563	0.492	0.492	0.437
F test of overall model fit	12.378	16.043		19.400	20.765	
F test P-value	0.000	0.000		0.000	0.000	

Notes: ***; **; and * represent significance at the 1%, 5%, and 10% level, respectively. Reported are robust standard errors clustered at the community level. Instruments for production diversity and cereal yield are average number of plots per parcel, contact with farmers groups or extension agents, use of chemical fertilizers and interactions with travel time to nearest daily market. Northern region is the omitted category.

3. M&E Activities Planned for Fiscal Year 2018

The following are the main M&E-related activities planned for FY18. Work plan may be revised depending on funding availability.

3.1. Manage program-generated agro-economic data

The team will continue managing program-generated data through the new data repository platform – Dataverse. Africa RISING page on Dataverse will also be linked to USAID's Development Data Library (DDL). The M&E team has been in discussions with the Sustainable Intensification Innovation Lab (SIIL) team to share lessons learned and leverage possible synergies. Through these discussions, the team has recently been introduced to a project and data management tool called Piestar[4] that is already being used by SIIL. Africa RISING management has shown strong interest in this tool and the M&E team will work with the Piestar and other AR colleagues to customize the tool to Africa RISING upon confirmation of the final decision on the use of the system.

3.2. Revise program data management plan

Accordingly, the AR program's data management plan (approved in October 2014) will be revised to reflect changes made to the data repository platform, USAID's requirements for data uploading/linking to the Development Data Library, and possibly about the Piestar system.

3.3. Conduct in-country trainings

Additional rounds of in-country trainings for AR researchers on project monitoring (eventually through Piestar) and data management in Dataverse and DDL will be organized and conducted.

3.4. Deploy the beneficiary and technology tracking tool (BTTT)

Upon hiring of the local M&E coordinators, the team will deploy the beneficiary and technology tracking tool (BTTT). The tool would allow researchers and program managers to uniquely link AR technologies to households and would facilitate interoperability of different types of data collected from agricultural trials, plot replications, and households for agronomic and socioeconomic analysis.

[4] https://www.piestar.com/

3.5. Aggregate and report the 2018 FtF indicators data

Per M&E mission, the team will continue to validate and aggregate Feed the Future indicators data shared by individual researchers through the PMMT for subsequent reporting and submission onto the FtF monitoring system.

3.6. Implement a follow-up evaluation survey

The M&E team expects to conduct at least one Africa RISING Follow-up Evaluation Survey (ARFES) in FY18 (likely in Malawi). Baseline line surveys have been implemented in Malawi, Tanzania, Ethiopia, Mali and Ghana during Phase I. Follow-up data are crucial to analyze the effects of AR technologies on longer-term economic and development outcomes. The focus country for ARFES will be determined after project funding is confirmed.

3.7. Research and outreach

The team will finalize the following research studies in FY18.

3.7.1. Determinants of farmers' willingness to pay for improved technologies (Tanzania)

Based on primary data collected from Babati district of Tanzania, this study examined farmers' willing to pay (WTP) for improved technologies. Using a contingent valuation experiment, we estimated the WTP for hybrid maize seed and local inorganic fertilizer. Preliminary results show that the average WTP is 62% higher for hybrid maize seed and 15% lower for inorganic fertilizer than their average local market prices, consistent with relatively high adoption of the former and limited adoption of the latter. Research article will be submitted to a relevant peer review journal *(Food Security)*

3.7.2. Correlates of the adoption of SI innovations (Tanzania)

Ensuring nutritionally adequate food supply in Africa south of the Sahara requires the sustainable intensification (SI) of its agricultural sector, especially in the face of expected population growth and climatic changes. This in turn necessitates expanding the suite of integrated technological options at hand. 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 rate across different farm types we develop (see below)

addressing five SI domains–productivity, environmental sustainability, social sustainability, economic sustainability, and human wellbeing. Preliminary econometric analysis shows adoption rates to be the highest (lowest) for farm types that score the highest (lowest) based on selected SI indicators. Research paper will be published as IFPRI Discussion Paper.

3.7.3. *Ex-ante* evaluation of AR technologies

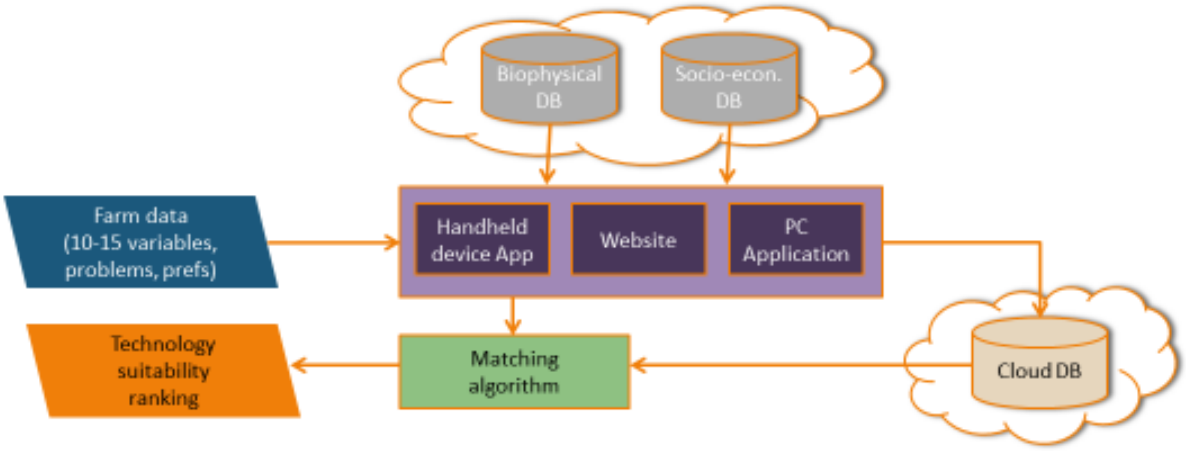
As discussed in Section 2, the *ex-ante* evaluation work from Zambia has produced policy relevant results. The team will continue this piece of work by focusing on new program countries and additional program technologies that demonstrated a potential during Phase I. The choice of AR technology/ies will be guided by the availability of good quality agronomic trial data that is crucial for DSSAT model calibration and validation. Research article will be submitted to a relevant peer review journal *(Agricultural Systems).*

3.7.4. Development of GIS- and typology-based technology recommendation domains

WUR, IITA, and IFPRI researchers have already started discussing on a study that combines household survey-based farm typologies with gridded biophysical and socio-economic data layers to generate sustainable recommendation domains for technology targeting and scaling up building upon the work by Muthoni et al. (2017).[5] The team expects to develop a methodology that combines a learning and matching algorithm (to identify suitable and promising technologies for a specific area) with a data mining and signaling algorithm (to identify hotspots of suitability of technologies and interest of farmers).

The evidence generated will allow AR researchers to rank most promising set of technologies for a farm, given its farm characteristics, socio-economic environment, and biophysical conditions as shown below.

[5] Francis K. Muthoni, Zhe Guo, Mateete Bekunda, Haroon Sseguya, Fred Kizito, Frederick Baijukya, Irmgard Hoeschle-Zeledon. 2017. Sustainable recommendation domains for scaling agricultural technologies in Tanzania. *Land Use Policy*, 66: 34–48.



3.7.5. Analysis of the linkages between agriculture, food security and gender

The team will continue exploring the linkages between gender, agriculture, and food security using baseline data collected through the Africa RISING Baseline Evaluation Surveys (ARBES). The specific focus of this research will be on how gender differences in access to and ownership of productive resources affects agricultural productivity and subsequent development outcomes, including poverty and nutrition. The evidence based on households included in the ARBES will be complemented with the information drawn from nationally-representative consumption, nutrition and agricultural survey data in the team's holdings. Research article will be submitted to a relevant peer review journal *(Journal of Development Studies).*

3.8. Contribute to and attend program- and project-level meetings

The M&E team will continue to actively contribute to and participate in various program- and project-level meetings. The team's continued presence and participation in these meetings will facilitate communication and interaction between the research teams and the M&E team about ongoing research activities on the ground and will help the AR program to better tailor its activities to the needs of the farmers involved, also in the light of the scale-up.

3.9. Recruitment of local M&E staff

M&E coordinators for all the three mega-sites will be hired for improved team's action on the ground, and effective backstopping of the field monitoring activities.

4. Conclusions

During FY2017 the M&E team has accomplished the following main activities:

- Conducted another round of updates to the data entry application of the Africa RISING Project Mapping and Monitoring Tool (PMMT). The updates include the addition of new Malawi sites as part of the expansion of Africa RISING activities (in Dedza, Ntcheu, Machinga, and Mangochi districts), as well as sites and indicators as part of the Integrating Nutrition in Value Chains (INVC) Bridging activity;
- Finalized the migration of Africa RISING datasets (from the original ILRI's data repository platform (CKAN) to the new platform Dataverse (managed by IFPRI) and prepared a Dataverse user guide. As per agreement with ILRI, the associated meta-data will remain on CKAN with hyperlinks to the raw data on Dataverse. ILRI-owned datasets will remain on CKAN with associated meta-data saved on Dataverse;
- Updated and shared AR monitoring data requirement guideline and supporting documentation;
- Developed household and community survey tools for Malawi Africa RISING Follow-up Evaluation Survey (ARFES). Field implementation of the survey has nonetheless been suspended due to the AR funding uncertainty;
- Conducted a partial analysis of experimental and secondary data from Zambia for an ex-ante evaluation of selected conservation agricultural (CA) practices (joint with CIMMYT researchers). This study uses a process-based cropping system model called Decision Support System for Agrotechnology Transfer (DSSAT) (Jones et al., 2003) that includes a suite of modules for simulating crop growth and yield as a function of soil water and nutrient dynamics, weather conditions, and farmers' management practices on a daily time-step;

- Based on the results of DSSAT model calibration and validation, the team will select the best performing CA option to scale up to current maize-producing areas of Zambia and for which agroeconomic expected gains from increased adoption of the CA practices will be estimated;
- Specifically, for West-Africa, the IFPRI M&E team was involved in setting up the BTTT, an updated framework for monitoring technology adoption to be used by the project team and scaling partners (output 4.3). The team will monitor and report technologies and their associated beneficiaries or farmers exposed to the innovations using the BTTT, eventually linked to the Piestar system, as needed.