Africa RISING East and Southern Africa Project: Phase II Project Logframe

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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/

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1 Summary

The East and Southern Africa (ESA) Region Project is one of the three regional projects operating in Tanzania, Malawi and Zambia under the title "Sustainable Intensification of Key Farming Systems in East and Southern Africa". It is managed by the International Institute of Tropical Agriculture, IITA.

During Phase I, research partnerships made positive strides towards fulfilling the project's objectives to develop strategies and initiatives that would help smallholder farmers to address poverty, hunger, and environmental degradation. Participatory and multi-disciplinary research was operationalized to facilitate (i) implementation of baseline studies that generated a critical mass of data and information that is available to guide prioritization, planning, and implementation of Phase II, (ii) new technology introductions that addressed immediate and obvious cause-effect situations – including new environment-smart and nutrition-improving crop varieties, livestock fodder, and approaches to reduce food waste and spoilage, and (iii) generation of scientific evidence necessary to define technology packages that address more complicated relationships requiring the integration of multi-disciplinary practices – including technologies driven by crop ecology, integrated soil fertility management, landscape scales and livestock integration. Results were communicated in different formats, but mainly in publications, reports, and success stories, and a few technologies were taken to pilot scale for uptake and adoption. Phase II proposes to build its continuity on the solid research partnership foundation but also on harmonized activities within ESA along common research and development outcomes. The ESA Project will strengthen strategic partnerships with development institutions, and leverage on their entrepreneurial approach for success in taking technologies to scale.

1.1 Vision of success

The ESA Project subscribes to the purpose and theory of change expressed in the umbrella document. The project will continue to generate research outputs that will support the farm-based households of smallholders to improve their livelihoods by increasing income and improving diets. Dependent on the livelihood strategy there will be different roles of farming, ranging from subsistence to enterprise-oriented agriculture. This implies a diversity of intensification pathways that utilize different packages of technologies and practices to realise sustainable intensification. Action research will be supported by extension material and rural development strategies that will be developed to stimulate technology and educational dissemination activities, and extended to about 300,000 households by the year 2021. These activities are designed to respond to the goals of smallholder households by (i) accelerating adoption of technology breakthroughs that promote sustainable land management, (ii) increasing diversification of crop and livestock production to improve household diets in a manner that favourably affects the most vulnerable smallholders, particularly women and children, and (iii) increasing adoption of value addition to, and the marketing of farm products as a means to improve incomes. Different sustainable production approaches are likely to be required within contrasting agro-ecological zones and socio-economic settings in what are otherwise similar smallholder systems and these will be addressed through typology characterization and targeting.

Building on current, and developing more functioning partnerships between research and development will be the basis for the envisaged success of Phase II of the ESA Project. Reasons for our pilot partnership success were recognised in the **Africa RISING mid-term review report**. The Figure 2 shows numbers of beneficiary households that the ESA Project is

targeting directly through the research process and in partnership with development projects. The projections are increasing because of the 3-year partnership with NAFAKA in Tanzania which was initially planned to last up to 2017, targeting about 80,000 household beneficiaries. NAFAKA is a consortium of international and local NGOs, as well as government outreach institutions. In Zambia, partnership for "Africa RISING going to scale in Eastern Province of Zambia" is with NGOs[1] and projects - Profit+, COMACO, TLC, SAIOMA and Grassroots Trust. The 2-year activity is also initially to last up to 2017 and targeting about 49,000 households. In Malawi, partnership with ACE, FUM, CADECOM, CRS and MISST to bridge INVC activities is starting during 2016-17 and planned to last up to 2018, and targeting about 57,000 households In Phase II, the ESA Project will continue to explore research and development partnership opportunities with the curent development partners with whom the partnership extends beyond Africa RISING Phase I, as well as with new partners. For example, the partnership with NAFAKA will likely continue after 2017 as Africa RISING is reflected in NAFAKA's Phase II approved proposal as being important in contributing to the science and practice of agronomy and reduction of food waste and spoilage (post-harvest product management). CRS has expressed interest to work with Africa RISING to scale the doubled-up legume technology in Zambia and Malawi, and vegetable technologies in Tanzania. Exploration of new partnerships leads us to assume at least an annual 10% increase in our beneficiary targets over the Phase II period. This partnership mechanism also ensures that the project activities have impact beyond the project life through continued promotion of the technologies by the organizations.

1.2 Moving from Phase I to Phase II

Phase II of Africa RISING in ESA is underpinned by the research outputs of ESA Project Phase I, but also guided by the harmonisation with the other two projects based on the approaches and principles outlined in the umbrella proposal. Research outputs are generated under seven broad strategies representing viable entry points for technological integration, being (i) genetic integration involving introduction of new crops and varieties to overcome existing stresses, (ii) manipulation of crop ecologies to get more crops on limited land and maximise biological nitrogen fixation, (iii) integrated soil fertility management as a cost-effective approach to replenish soil fertility, (iv) introduction of land management technologies to reduce soil loss and enhance water utilisation, (v) improved livestock feed quality and quantity, (vi) introduction of post-harvest approaches to reduce food waste and improve food safety, and (vii) introduction of nutrient rich food crops for improved household nutrition. Details of the flagship technologies under these strategies are given in Annex II. Bringing these technologies together in creative ways will begin to tip the scales in favour of sustainable farming. There will be need for integration of scientific evidence generated in Phase I into decision-guides and principles that can be taught and scaled out as simple rules of thumb and packages targeting agroecosystem and socio-economic circumstances, defined by the SI domains (productive, economic, social, human and environmental). It is the scientific information backing these packages that will form the basis for engaging development partners with whom we plan to conduct R-in-D and quickly scale up to beneficiary numbers that Africa RISING alone is unable to achieve.

[1] The acronyms in this paragraph stand for: Profit+ (Production, Finance and Improved Technology); COMACO (Community Markets for Conservation); TLC (Total Land Care); SAIOMA (Strengthening Agricultural Input and Output Markets); ACE (Agricultural Commodity Exchange); FUM (Farmers Union of Malawi); CADECOM (Catholic Development Commission); CRS (Catholic Relief Services); MISST (**Malawi** Improved Seed Systems and Technologies); INVC (Integrating Nutrition in Value Chains).

Phase II will also explore new research areas emerging from Phase I experiences and feedback. Notable are (i) labour-saving mechanization solutions for small-scale farmers, and (ii) focusing attention on climate-smart solutions. One complementary approach is to introduce crop insurance and insurance-linked credit mechanisms that have emerged as promising market-based solutions for safeguarding farmers against crop failure due to adverse weather and climatic conditions.

We have also learned the importance of gathering feedback from the farmers and other stakeholders which allows for adaptation and iteration of activities during the research process. The ESA Project will operationalize R4D/Innovation Platforms as one major vehicle for this process, making them more effective, autonomous, and inclusive, especially of the private sector, for sustainability. They are meant for research priority setting, design, and dissemination. This approach will make it possible for research to package and complete the development of SI innovations and support their delivery and adoption in the region to achieve the planned outcomes.

2 About the Africa RISING ESA Project

In tandem with the umbrella **purpose of Africa RISING**, the ESA Project acts through action research and development partnerships, to 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. This is guided by the unique characteristics of, and challenges and opportunities existing in the ESA project countries of Tanzania, Malawi and Zambia (Figure 1).

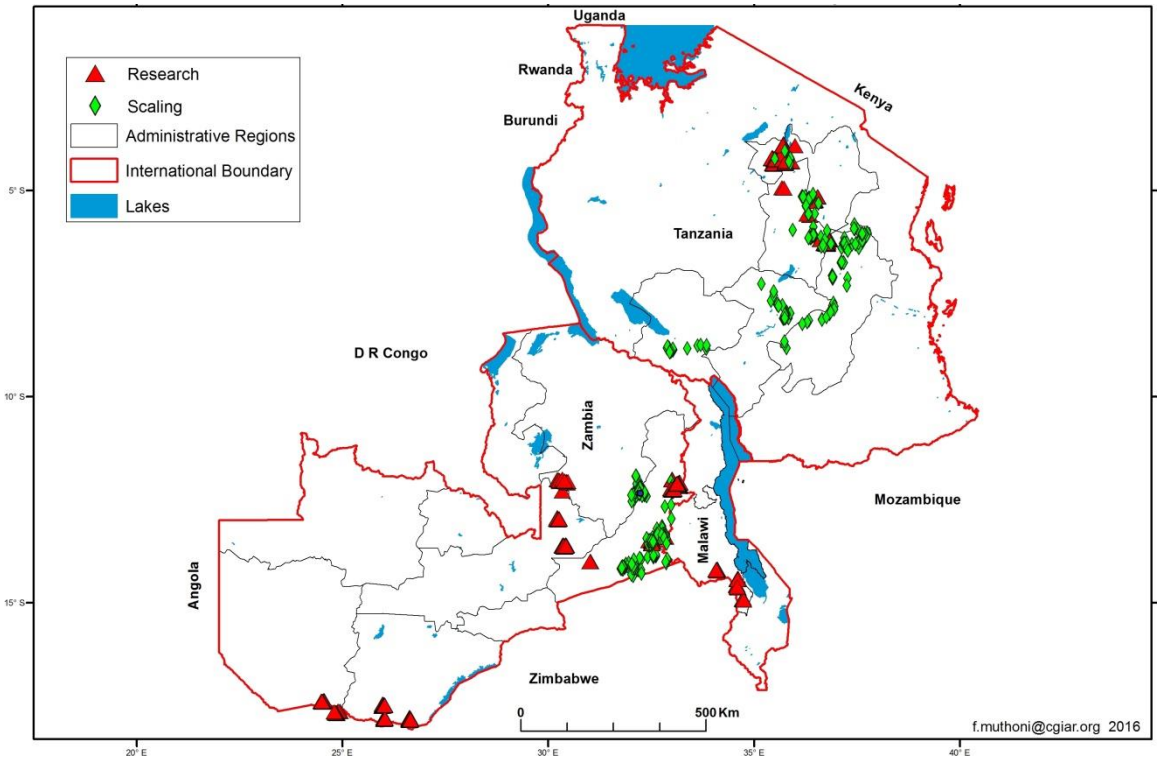

Figure 1: Africa RISING ESA Project countries and location of research/demonstration (learning) sites during Phase I

NOTE: In Figure 1 above, each plot represents a host-household except in Malawi where plots refer to action sites known as Extension Planning Areas. Plots for Tanzania and Zambia include both research and demonstration (research + development partnership learning) sites while those in Malawi are only research managed. Research + development partnership activities in Malawi are starting during 2016/17. During Phase II, activities will be extended to new sites while outcome studies will examine adoption on old sites based on surveys with site hosts, learners and non-beneficiary observers (spillover effects).

2.1 Characteristics of the ESA Project region

As in most of sub-Saharan Africa, agriculture is the main source of livelihoods for the majority of the population in Tanzania, Malawi, and Zambia (AGRA, 2013)[2], the three Africa RISING countries in East and Southern Africa (ESA). The sector employs over 80% of the population and contributes 25% to the GDP of the countries (Table 1). However, despite

[2]Alliance for a Green Revolution in Africa (AGRA). 2013. *Africa Agriculture Status Report: Focus on Staple Crops*. Nairobi, Kenya.

some achievements over the past ten years[3], productivity of the sector is still low, especially for cereals – current mean yields are about half of their potential[4]. This in turn compounds food insecurity, poverty and malnutrition problems in the three countries.

Table 1: ESA project country information

Country	Population (2014, est. in millions)	Population growth rate (%)	Agricultural labor force (%)	Population below poverty line (%)	Agriculture as a percentage of GDP	Global Hunger Index	Cereal production (t/ha)
Tanzania	52	2.8	80	28.2 (2012)	31	28.7	1.4
Malawi	17	3.3	90	50.7 (2010)	33	27.3	2.1
Zambia	16	2.9	85	60.5 (2010)	10	41.1	2.5

Sources: World Bank (http://data.worldbank.org/) and IFPRI (http://ghi.ifpri.org/)

Smallholder livelihoods are predominantly farm-based and this agriculture is highly dependent on weather patterns, especially with respect to rain. A diversity of crops is grown; cereals and starchy roots and tubers are dominant. Cattle dominate the livestock sector in the ESA action sites in Tanzania; small ruminants dominate in the action sites in Malawi and Zambia. Poultry is an important component in the three countries. As the human population increases, production has been, for the most part, increasing as a result of land clearance for crops at the expense of land available for other production activities (e.g., livestock). With the challenges of poverty, malnutrition, population growth, and vagaries of weather exerting an impact on agricultural productivity greater attention needs to be shifted to sustainable agricultural intensification, potentially leading to increased productivity as one of the results necessary for improving the livelihoods of the population in the region, but also to minimize negative impacts on natural resources.

2.2 Challenges and opportunities

A number of key challenges affect agricultural productivity in the three countries. Notable among these are land degradation and (inherent) poor soil fertility; climate variability; crop pests and diseases; low adoption of proven agronomic practices as a result of inadequate access to information and unreliable agro-input supply systems; institutional barriers (poor markets for inputs and farm products and poor farmer organization); lack of quality livestock feed and pasture, management practices and breeds; postharvest management (losses) processing; and food safety.

2.2.1 Land degradation and poor soil fertility

The diverse agro-ecological zones in the three countries all face different levels of land degradation, with the arid and semi-arid areas exhibiting the highest levels characterized by soil loss (Pingali *et al.,* 2010)[5]. The soils in the region are also inherently poor in terms of fertility making this a leading biophysical cause of low agricultural productivity (Sanchez, 2002)[6]. The situation is further compounded by low use of fertilizers and organic amendments (AGRA, 2013). In Babati District of Tanzania (one of our action sites), Kihara *et*

[3]World Bank (2016).*World Development Indicators 2016*. Washington DC: World Bank

[4]Macauley, H & Ramadjita, T. (2015). Cereal crops: rice, maize, millet, sorghum, wheat. *Background paper presented at the Feeding Africa Conference. (21- 23 October, 2015)*. Dakar, Senegal.

[5]Pingali, P., Gingerich, C., and Wood, S. (2010, September). *Poverty and smallholder agriculture in sub-Saharan Africa: Targeting R&D.* Paper presented Invited paper presented at the 3rd Conference of the African Association of Agricultural Economists, Cape Town, South Africa.

[6] Sanchez, P.A. (2002). Soil fertility and hunger in Africa. *Science,* 295, 2019-2020.

al. (2014)[7] established that at least 52% of the fields had negative nutrient balances. In Kongwa and Kiteto, the baseline soil fertility indicators of soil organic carbon (0.3-1.9%), total nitrogen (0.03-0.15%), and cation exchange capacity (4.4-10.2 cmol(+)/kg soil) range from very low to low (http://www.slideshare.net/africa-rising/esarp2015-kimaro-51898813)

The weak demand for external inputs by small-scale farmers is due not so much to their limited capacity to invest in farm improvement but to their lack of know-how and information on management options (notably the organic and biological sources –increased use of legumes) that would allow low, efficient, and combined rates of application, lower external input costs, and enhance the value of locally available inputs. There is therefore an opportunity to demonstrate the role of integrated soil fertility management (ISFM) in maintaining the soils' integrity for posterity at affordable costs. Approaches to nutrient restoration and use efficiency must be tailored to meet variations in soil properties and management conditions.

2.2.2 Climate variability

The most potent manifestation of climate variability that has an immediate impact on agricultural productivity is the change in rainfall patterns – inadequate or uneven distribution of rainfall exacerbated by climate change and already being experienced across the three countries. The Intergovernmental Panel on Climate Change (IPCC) estimates that climate change in SSA will reduce crop yields by 8% by 2050 (Porter *et al.*, 2014[8]), with estimated yield losses of up to 20% in ESA for maize, a major crop in the region, and one of the most vulnerable (Zinyengere *et al.*, 2013[9]). Africa RISING scientists have opportunities to generate and make available climate-smart technologies that will help to assuage this problem. Scaling of information on weather and climate-smart technologies could make use of proven ICT-led innovations available in the region (AGRA, 2014[10]).

2.2.3 Lack of quality livestock feed and pasture, management practices, and breeds

Livestock development was envisioned as offering more opportunities for improving security in food, nutrition, and income in Tanzania where cattle rearing is predominant. Even here, however, only those systems that integrate livestock, mainly cattle and poultry, in the crop production systems are considered under the Africa RISING mandate. Although several problems were identified (including availability of appropriate breeds for high productivity and postharvest handling of livestock products to allow better market access), the main challenge is how to ensure profitable production on the limited natural resource base. Thus, the choice entry point is the provision of better quality and increased fodder and feed, given that livestock have access to as little as 30% of the required feed during the dry season, and are not fully fed even during the wet season (http://www.slideshare.net/africa-rising/esa-rp2013-babati-26159104?qid=0db12836-c2d8-4383-9502-87658d34ee43&v=&b=&from_search=10).

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[7] J. Kihara, L. D. Tamene, P. Massawe, and M. Bekunda (2014). Agronomic survey to assess crop yield, controlling factors and management implications: a case-study of Babatiin northern Tanzania.NutrCyclAgroecosyst DOI 10.1007/s10705-014-9648-3

[8]Porter, J.R., L. Xie, A.J. Challinor, K. Cochrane, S.M. Howden, M.M. Iqbal, D.B. Lobell, and M.I. Travasso, 2014: Food security and food production systems. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 485-533.

[9]Zinyengere, N., Crespo, O. and Hachigonta, S. (2013). Crop response to climate change in southern Africa: A comprehensive review. *Global and Planetary Change*, 111, 118-126. https://doi.org/10.1016/j.gloplacha.2013.08.010

[10]Alliance for a Green Revolution in Africa (AGRA). 2014. *Africa Agriculture Status Report: Climate Change and Smallholder Agriculture in sub-Saharan Africa*. Nairobi, Kenya.

The research opportunity is in demonstrating that the establishment of high quality fodder species on underutilized land patches, such as field boundaries and contour hedges, would not only allow an increase in both the quality and availability of feed and improve feeding regimes when combined with chopped maize stover for better digestibility but also contribute to the physical management of soil and soil-water resources. Livestock manure could be efficiently utilized in soil fertility management. These activities would maximize locally available resources for developing quality feed.

2.2.4 Postharvest management and processing; food safety challenges

According to the World Resources Institute, approximately 23% of available food in sub-Saharan Africa is lost or wasted (Lipinski et al. 2013[11]). This is equal to the loss of 545 kilocalories per person, per day across a sub-continent where 24.8% of the population is undernourished (FAO 2013[12]). Mycotoxins contamination is, in part, caused and/or increased by poor handling of produce and storage practices. In a maize-based farming system in semi-arid areas of Central and Northern Tanzania, quantitative pre- and postharvest losses of economic importance occur in the field (15%), during processing (13-20%), and during storage (15-25%[13]). Many simple tools and approaches exist for reducing postharvest loss and spoilage; however, uptake and adoption by smallholder farmers remain limited, in part due to lack of awareness of these alternatives and skills to use them. The ESA Project has the opportunity to demonstrate and promote access to effective technologies that reduce product spoilage and degradation during handling and storage, and allow farmers to hold their crops for extended periods of time, also contributing to better returns from sales during periods of low availability. Produce saved can also reduce the rates of acquiring and committing more land area to agriculture.

2.2.5 Adoption of proven technologies

Agricultural productivity for farming systems in the ESA region could be enhanced if the available technologies were adopted and scaled up. However, the current extension system in the three countries is ineffective for several reasons, including inadequate funding and human resources, poor facilitation/motivation, low use of ICTs to complement interpersonal methods, and insufficient access by extension workers to up-to-date information. The increase in numbers of extension staff in the three countries has not matched that of farmers over the years and as a result less than 30% of farmers are served by national extension systems in developing countries including the three ESA countries (Bell, 2015[14]). The ESA project team has an opportunity to partner with key stakeholders in each country (local government, NGOs, and donor-funded bilateral development projects) to adopt and adapt technology dissemination approaches that have the potential to take proven technologies to scale.

In addition to lack of information, there are other institutional barriers which, in retrospect, affect the adoption and scaling of proven technologies. These include unreliable agro-input supply systems which perpetrate the promotion of counterfeit inputs, poor markets for farm products, and poor farmer organization. In the three countries, Africa RISING scientists have

[11] Lipinski, B., Hanson. C., Lomax, J., Kitinoja, L., Waite, R. and Searchinger, T. (2013). *Reducing Food Loss and Waste*. Washington, DC: World Resources Institute

[12]Food and Agriculture Organization. *Food security indicators. 2011-2013*. Retrieved from: http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/#.U3OF8ygSdqI

[13]Adebayo B. Abass, Gabriel Ndunguru, Peter Mamiro, Bamidele Alenkhe, Nicholas Mlingi and Mateete Bekunda (2014).Post-harvest food losses in a maize-based farming system of semi-arid savannah area of Tanzania. Journal of Stored Products Research 57:49-57.

[14]Bell, M. (2015). ICT – Powering Behaviour Change to a Brighter Agricultural Future. *MEAS Discussion Paper*. October 2015.

had the opportunity to identify promising models of agro-input networks, marketing, and farmer organization that could be further examined and adapted for scaling the proven technologies.

2.2.6 Access to markets and poor farmer organization

Sustainable intensification requires the proper functioning of the marketing system. Indeed, it is difficult to sustain output and productivity growth without efficient output markets which offer a means of absorbing surpluses resulting from improved farm technology (AGRA, 2013[15]). Studies conducted in ESA and elsewhere show that a well-functioning marketing system is necessary for the adoption of improved agricultural technologies (Kassie *et al.*, 2013[16]; Kassie *et al.*, 2015[17]). Farmers as producers of different crops and livestock, depend on markets to sell their products and to spend their income as consumers of various products including farm inputs. In fact, selling and buying are intertwined within agricultural production and hence weakness of the marketing system at one point of the value chain will affect performance at the others.

The marketing systems (both output and input) are poorly functioning in ESA and (Eskola, 2005[18], ASARECA, 2008[19], Jayne *et al.*, 2010a[20]). This is linked to complex problems including poor infrastructure and weak institutions. The region is characterized by a poor road network. Most of the good roads are limited to major marketing centers and most rural towns are not connected by good roads (Eskola, 2005, Ondiege, 2013[21]). Village roads are impassable by vehicles particularly during rainy seasons and the cost of transport is pushed up in these areas. Postharvest facilities for grains and other agricultural commodities are also poor. Farmers use traditional means of storage which are vulnerable to storage pests and moisture; most processing activities (winnowing, de-hulling, drying, sorting, and shelling) are carried out manually (Abass et al. 2014[22]). These poor facilities have contributed to postharvest losses and seasonal gluts that dampen producers' incentives.

Agricultural products in ESA are also constrained by a lack of institutions that can reduce transaction costs; these include inadequate quality standards, weak inspectorate mechanisms at various levels, and weak enforcement of agricultural marketing regulations (Eskola, 2005; Kawa and Kaitira, 2007[23]). Moreover, most smallholder farmers are not organized, have very little information on markets, including output prices, have little market orientation and few entrepreneurial skills, and cannot gain access to credit to enable them to store their produce when prices are low and sell out when prices get better (Eskola, 2005, Kawa and Kaitira, 2007 and Jayne *et al.,* 2010b[24]). As a result, their bargaining power

[15] Africa Agriculture Status Report: Focus on staple crops. Alliance for Green Revolution in Africa, Nairobi, Kenya. 2013.
[16]Kassie, M., Jaleta, M., Shiferaw, B., Mmbando, F., and Mekuria, M. (2013). Adoption of Interrelated Agricultural Practices in Smallholder Systems: Evidence from Rural Tanzania. Technological Forecasting & Social Change, 80: 525-540.
[17]Kassie, M., Teklewold, H., Jaleta, M., Marenya, P., and Erenstein, O. (2015). Understanding the Adoption of a Portfolio of Sustainable Intensification Practices in Eastern and Southern Africa. Land Use Policy, 42: 400–411
[18]Eskola, E. (2005). Agricultural Marketing and Supply Chain Management in Tanzania: A Case Study. ESRF Study on Globalisation and East Africa Economies, Working Paper Series No. 16
[19] ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa). (2008). Responding to the food price crisis in Eastern and Southern Africa: Policy options for national and regional action. ASARECA, Entebbe.
[20] Jayne, T. S., Sitko, N., Ricker-Gilbert, J., and Mangisoni, J. (2010a). Malawi's Maize Marketing System. Unpublished report, February 2010. http://fsg.afre.msu.edu/malawi/Malawi_maize_markets_Report_to-DFID-SOAS.pdf, accessed on 19 April, 2016.
[21]Ondiege, P., Moyo, J.M and Verdier-Chouchane, A. (2013). Developing Africa's Infrastructure for Enhanced Competitiveness.The Africa Competitiveness Report 2013.World Economic Forum.
[22]Abass, B.A. Ndunguru, G., Mamiro, P. Alenkhe, B. Mlingi, N., and Bekunda, M. (2014).Post-harvest food losses in a maize-based farming system of semi-arid savannah area of Tanzania. Journal of Stored Products Research, 57: 49-57.
[23]Kawa, I.H. and Kaitira, L.M. (2007). Enhancing Smallholder Farmers' Market Competitiveness in Tanzania. Case study #6-7 of the program: "Food Policy for Developing Countries: The role of the government in the global food system."
[24] Jayne, T.S., Mason, N. Myers, R. Ferris, J., Mather, D., Lenski, N., Chapoto, A. and Boughton, D. (2010b). Patterns and Trends in Food Staple Markets in Eastern and Southern Africa: Toward the identification of priority investment and strategies for

on prices and marketing modalities is very limited. The position of smallholder farmers as market participants is further weakened by their pressing necessity to meet cash needs after harvesting. Sometimes marketing problems are manifested by the unpredictability of macro-level institutions limiting long-term investment in marketing facilities. For instance, Malawi, Zambia, and Tanzania banned maize exports in 2008 which made trading firms suspend investment in developing durable marketing networks across regions (Jayne *et al*., 2010b).

The poor marketing system affects smallholder farmers in two ways. First, prices become highly volatile which, in the absence of adequate information, is most likely to reduce the mean revenue among smallholder farmers from product sales. Secondly, the poor marketing system increases costs of both production and marketing. The impact will be low net income from agricultural production which results in lower incentives to adopt improved agricultural technologies.

Despite these challenges, there are huge marketing opportunities in the region. Domestic demand for agro-processed products, particularly food products, has increased both in rural and urban areas of ESA countries and has resulted in the emergence of supermarkets and fast-food outlets (Eskola, 2005). Moreover, the possibility of regional integration which expands demand for agricultural products and the expansion of ICT to support information flow among marketing actors make opportunities available to improve agricultural marketing in the region (Khandelwal, 2004[25]). However, smallholder farmers and other domestic market actors have not been able to take advantage of these emerging marketing opportunities. Research on value addition, how various stakeholders (including smallholder farmers, processors, traders, and consumers) are effectively interlinked, and alternative marketing information channels, among other things, will help to exploit emerging market opportunities.

developing markets and promoting smallholder productivity growth. MSU International Development Working Paper No. 104. http://ageconsearch.umn.edu/bitstream/62148/2/idwp104.pdf (accessed on 19/4/2016).

[25]Khandelwal, P. (2004). COMESA and SADC: Prospects and Challenges for Regional Trade Integration. IMF Working Paper, WP/04/227

3 Project vision of success

ESA Project II vision of success is based on the premise that technology breakthroughs occurring through research can improve the lives of the smallholder farmers if they are fine tuned to more site-specific agricultural and socio-economic settings, and mechanisms are developed to put these technologies into farmer practice. ESA Project research partners have, and will continue to develop proven SI technologies, and their operational approach with development partners (R-in-D) who have expertise in design and implementation of integrated community-based scaling will seek to meet impact targets as described below. These approaches have been piloted during Phase I; research and development partners successfully worked together to assist farmers to access and better use farm inputs, cropping and livestock management technologies and practice natural resources conservation. As a result, the beneficiary households at the end of the ESA Project Phase I (2016) are about 58,000, which is more than 10 times the original targets set for the research component (Table 2).

3.1 Impact targeting

The mandate for research partners was to identify and evaluate candidate technologies through participatory, on-farm approaches which, by their nature engage few farm households. During the latter part of Phase I, researchers realised that combining the best performing interventions into information and technology packages and field testing them through networks of development projects would create an opportunities for identifying the most effective interventions that would be mainstreamed into wider rural development programs beyond ESA Project zones of influence.

Partnerships were developed, initially with FtF supported development projects (see section 6.4 of the **Africa RISING ESA phase 2 project proposal**) whose visions of success required availability of informed productivity enhancing innovations for scaling-up and -out in the target communities. Both research and development projects are cognizant of the mutual benefits and synergies that would accrue from joint undertakings; Africa RISING generates these innovations as its outputs and development partners provide opportunities for learning through action research (R-in-D) and scaling-up and -out of the research innovations. In Phase II, the ESA Project will continue to explore these opportunities with the curent development partners with whom the partnership extends beyond Africa RISING Phase I, as well as new partners (including non-USAID supported – Table 2) and thus increase the return to investment by USAID Feed the Future in the three countries' zones of influence. The success of these partnerships form the basis for the proposed beneficiary targets are given in Figure 2 and Table 2.

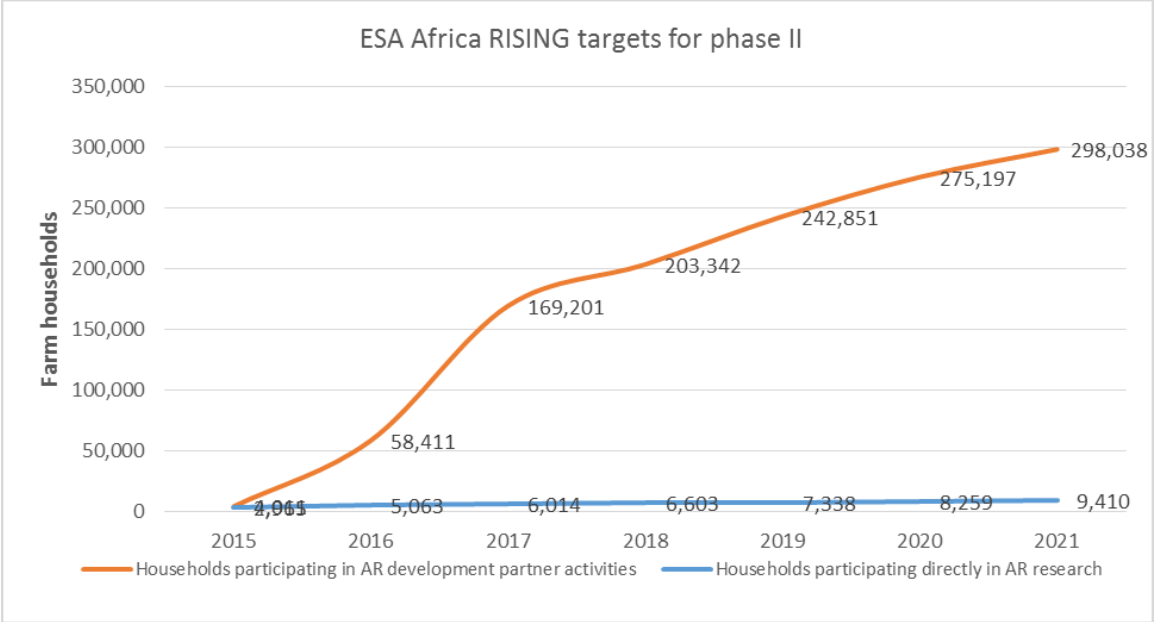


Figure 2: Target beneficiary households for Africa RISING – ESA Project, Phase II

Table 2: Impact targets (households in FtF – ZoI) and progress toward impact (beneficiary households) for the ESA Project, 2015-2021

Impact targets	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Households participating directly in AR research	**2,965**	**5,063**	**6,014**	**6,603**	**7,338**	**8,259**	**9,410**
Tanzania	1,659	1,710	1,773	1,852	1,950	2,073	2,228
Malawi	1,306	1,633	2,041	2,551	3,188	3,986	4,982
Zambia		1,720	2,200	2,200	2,200	2,200	2,200
Households participating in AR development partner activities	**4,011**	**58,411**	**169,201**	**203,342**	**242,851**	**275,197**	**298,038**
Tanzania	2705	16,070	82,800	91,080	100,188	110,207	121,227
Malawi	1306	12,796	39,645	65,506	95,907	118,234	130,055
Zambia		29,545	46,756	46,756	46,756	46,756	46,756
Total households in FTF zones of influence	**2,192 million**	**2,656 million**	**2,740 million**	**2,823 million**	**2,906 million**	**2,988 million**	**3,072 million**
Tanzania	1,004 million	1,037 million	1,070 million	1,102 million	1,135 million	1,167 million	1,200 million
Malawi	1,188 million	1,226 million	1,265 million	1,303 million	1,341 million	1,379 million	1,417 million
Zambia		392,893	405,229	417,566	429,903	442,240	454,577

Building on current, and developing more functioning partnerships between research and development will be the basis for the envisaged success of Phase II of the ESA Project. Reasons for our pilot partnership success were recognized in the **Africa RISING mid-term review report** (Annex 1). The Figure above shows numbers of beneficiary households that the ESA Project is targeting directly through the research process and in partnership with development projects. The projections are increasing because of the 3-year partnership with NAFAKA in Tanzania which was initially planned to last up to 2017, targeting about 80,000

household beneficiaries. NAFAKA is a consortium of international and local NGOs, as well as government outreach institutions. In Zambia, partnership for “Africa RISING going to scale in Eastern Province of Zambia” is with NGOs Profit+, COMACO, TLC, SAIOMA and Grassroots. The 2-year activity is also initially to last up to 2017 and targeting about 49,000 beneficiaries. In Malawi, partnership with ACE, FUM, CADECOM, CRS and MISST to bridge INVC activities is starting during 2016-17 and planned to last up to mid-2018, and benefitting about 57,000 beneficiaries. In Phase II, the ESA Project will continue to explore research and development partnership opportunities with the current development partners with whom the partnership extends beyond Africa RISING Phase I, as well as with new partners. For example, the partnership with NAFAKA will likely continue after 2017 as Africa RISING is reflected in NAFAKA’s Phase II approved proposal as being important in contributing to the science and practice of agronomy and reduction of food waste and spoilage (post-harvest product management). CRS has expressed interest to work with Africa RISING to scale the doubled-up legume technology in Zambia and Malawi, and vegetable technologies in Tanzania. Exploration of new partnerships is expected to leads to an annual increase of at least 10% in beneficiaries over the Phase II period. This partnership mechanism also ensures that the project activities have impact beyond the project life through continued promotion of the technologies by the organizations.

4 Theory of change

A theory of change is a systematic assessment of what needs to happen in order for the desired outcomes of the program to occur. It is designed to explain how and why change happens, as well as the potential role of the work of the organizations involved in contributing to their vision of progress[26].

For Africa RISING, the adoption of research-derived innovations directed at the SI of smallholder agricultural production systems allows rural households to make more efficient use of the resources available to them. Consequently, they can produce more without compromising the needs of future generations. This increased production can translate into a range of livelihood outcomes through improved income flows, better household nutrition, and increased human capacity.

If the research conducted accounts for multiple sustainability domains (productive, economic, social, human and environmental), the long-term equity and viability resulting from the SI innovation, developed and promoted by the Africa RISING program, will be enhanced. A demand-driven approach based on long-term engagement with both research and development partners ensures that appropriate SI innovations will ultimately be scaled to receptive and informed beneficiary households.

Africa RISING will continue to follow a nested theory of change (ToC) adapted to more clearly support phase II of the program. At the top level in the ToC, two distinct types of research are identified with significantly different types of outcomes.

Methodological and diagnostic
Much of the research in this category seeks to reveal the nature of the target systems, and the constraints and opportunities characteristic of these systems. Other generic methodical and diagnostic (M&D) research seeks to understand more clearly and identify potential improvements in the SI processes. Direct SI impacts attributable to this type of research are not anticipated. Its outcomes are more facilitative and the research outputs delivered will help to ensure a more demand-driven[27] focus for the action-oriented research (see below). These outputs will also improve the relevance and targeting of the action-oriented research outputs, improving their adoptability and potential to generate impact. Much of the Africa RISING M&D research has been implemented during phase I, so phase II will not be replicating these broad diagnostic studies which were the focus of the first 18 months of the project. It is likely though that some of the research-in-development (R in D) partnerships at the core of phase II will require specific diagnoses of constraints and a stratification of intended beneficiaries to improve relevance and adoptability of promoted interventions.

Embedded in the M&D section of the theory of change, three major types of M&D research seeking to clarify different key issues relating to SI and the identification of appropriate SI trajectories are distinguished:

- **System diagnosis**: this research covers all aspects of the biophysical and social characterization of the target systems and communities for Africa RISING. It includes

[26] From http://www.geofunders.org
[27] Demand-driven: caused or determined by demand from clients or consumers. For Africa RISING, this implies that: (i) demand must be formally identified to drive the program activities, hence the extensive phase I diagnostic activities; (ii) the priorities of any group, including clients and consumers, are not static so an awareness of how demand evolves is built into the program; and (iii) the composition of client groups evolves, necessitating regular demand monitoring.

the identification of researchable constraints and opportunities, and a thematic research prioritization.

- **Trade-off analysis**: conducting systems diagnoses can identify potential solutions for constraint alleviation and promising SI trajectories; however, multiple stakeholders and multiple objectives within households mean that these are always subject to unintended consequences and trade-offs which may outweigh the benefits realised—and will clearly limit adoptability. Formal trade-off analyses allow for the rejection of options compromised by these externalities and/or identification of mitigating measures to strengthen promising interventions.
- **Typologies and equity**: diversity in target groups has two major consequences for SI-related innovations: i) one size does not fit all; most innovations are only adoptable by sub-groups within a target community; and ii) taking a portfolio of SI interventions as a whole, such as that developed by Africa RISING, must ensure equitable access so that all sub-groups have options which are appropriate for them. The use of household typologies, coupled with effective *ex-ante* impact assessment and well-targeted action-oriented research, helps to ensure these principles are met.

Action-oriented

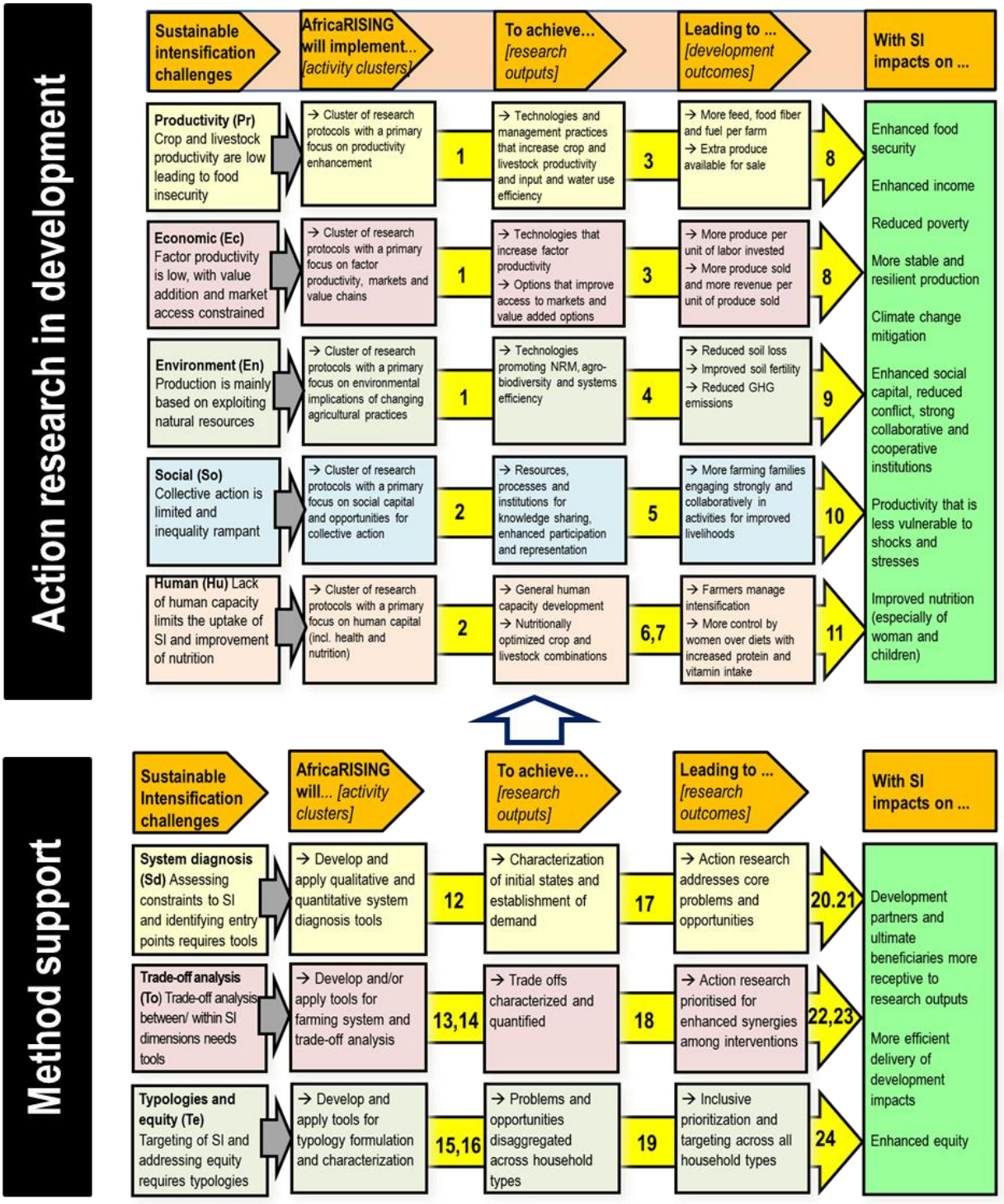
The phase I projects of Africa RISING all implemented broad-based action research—prioritized via the M&D research undertaken—to identify, test and validate interventions/innovations that promote SI and its benefits across multiple domains for stakeholders. This kind of research will continue, to varying degrees, across phase II projects, but will be augmented by action-oriented research specifically linked to development partnerships scaling Africa RISING and associated technologies (i.e. the outputs of phase I).

All Africa RISING action-oriented research is directly linked to developmental impacts in one or more of the five SI domains:

- **Productivity**: interventions targeting the productivity domain seek to promote directly the intensification part of SI with impacts on food security and income;
- **Economic**: research in the economic domain focuses on factor productivity and the value chain function with the ultimate aim of impacting on poverty levels and prevalence;
- **Environmental**: research in this domain needs to identify unintended environmental consequences of innovations promoting productivity and economic wellbeing (in particular), as well as landscape scale interventions to support SI. Targeted impacts include more stable and resilient production, and the mitigation of environmental damage.
- **Social**: the outcomes of research in this domain include strengthening of social capital, and identifying and supporting opportunities for collective action to impact beneficially on social cohesion; and
- **Human**: major elements of the human domain for Africa RISING are the health and nutrition outcomes generated along SI trajectories. These may be targeted both directly and indirectly on the general wellbeing and capacity of individual beneficiaries.

While Africa RISING research activities may primarily target one domain, all are likely to result in outcomes across several domains. This can be beneficial in strengthening adoptability, but also necessitates a clear vision of potential negative trade-offs.

Figure 3. Developmental impact of Africa RISING action-oriented research



Assumptions (A) and risks (R)	
	1. (A) Results of methodological and diagnostic analysis incorrect and/or not considered 2. (A) Adequate quantitative and qualitative databases for social analysis 3. (A) Availability of and access to inputs; functioning markets; technologies and management practices effectively disseminated and adopted 4. (A) Technologies and management practices effectively disseminated and adopted 5. (A) Functioning partnership platforms with adequate stakeholder representation 6. (A) Bio-fortified and diverse crops, plus combinations with livestock lead to increased nutrition; absence of external limiting factors (e.g. bad water, sanitary conditions) 7. (A) Presence of young women attending awareness raising activities; minimum level of women decision making power within a household 8. (A) Absence of other shocks affecting farmers; presence of enabling environment for adoption; level of excess production not distorting market prices 9. (A) Wider adoption of technologies across multiple farmers; farmers' awareness of absence of short-term benefits 10. (A) Social context promoting collective action 11. (A) Adequate and functioning WASH infrastructure 12. (R) Measurement errors, challenges in data collection 13. (R) Incomplete database to address analysis 14. (A) Adequacy of the models 15. (R) Inadequate databases for typologies formulation 16. (A) Typologies reflecting existing farm types 17. (R) Change in demand for technologies due to external factors 18. (R) Researchers embed the trade-off analysis into their research prioritization 19. (R) Missing testing and validation of model findings; errors in interpretation 20. (R) Research outputs and recommendations are attractive to ultimate beneficiaries 21. (A) Uncertainty in buy-in from development partners and ultimate beneficiaries 22. (A) Farmer awareness of risks associated to adoption of innovations 23. (R) Important farmer risk aversion 24. (A) Actual use of typologies by research teams

5 Logframe

Intervention logic	Objectively verifiable indicators	Means/source of verification	Important assumptions
Purpose Provide pathways out of hunger and poverty for small holder families through sustainably intensified farming systems that sufficiently improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.	• Percentage change in income of household due to intensified farming system • Percentage of children below 5 years that have adequate nutrition and normal growth • Percentage farm area restored to sustainable land use	• Program ex-post evaluation report by IFPRI • Poverty monitoring surveys by local governments • Household expenditure surveys in project action sites by local governments	• Partner countries continue to invest in agriculture in a way that compliments program activities • Feed the Future priority countries and investments remain consistent with project • Political stability in countries with intervention sites
Project Outcome 1: Productivity, diversity, and income of crop-livestock systems in selected agro-ecologies enhanced under climate variability	• Percentage change in production of livestock system • Percentage change in crop and livestock diversity • Percentage change in income of direct beneficiary	End of project survey report by IFPRI	• Donor support remains sustained • Target areas remain conflict free • Extreme events do not impact target areas (e.g. Fires, floods, droughts)
Output	**Objectively verifiable indicators**	**Means/source of verification**	**Important assumptions**
Output 1.1: Demand-driven, climate-smart, integrated crop-livestock research products (contextualized technologies) for improved productivity, diversified	• Numbers of research products (farmer approved varieties, technologies and their associated recommendations) assessed for performance across SI domains	• Research products data bases (CKAN) • Research products described in published reports and journal papers	• Demand for technologies and research products developed • Resource (human and financial) flow is

diets, and higher income piloted for specific typologies in target agro-ecologies [and scaled in Outcomes 4 and 5].	(environment, production, economic, social, and human) • Numbers of beneficiaries trained (at multiple scales: farmer, extension, researchers, students, other stakeholders, policy makers) • Numbers of partnerships and innovation platforms developed to support early adoption • Extent of adoption of technologies and associated research products • Numbers of recommendations developed based on impact in multiple SI domains of research products for different scenarios	(AR reports) • Partnership agreements and function (wiki and AR reports) • Reports on ICT delivery modes developed • Training reports and student thesis (AR reports) • Country level release of recommendations, technologies and research products (AR program reports and gazette)	maintained • Government support - political will and policy
Output 1.2: Demand-driven, labour-saving and gender-sensitive research products to reduce drudgery while increasing labour efficiency in the production cycle piloted for relevant typologies in target areas [and scaled in Outcomes 4 and 5]	• Number of research products and recommendations that are gender sensitive and labour saving identified and suitability assessed for target groups and areas • Number of beneficiaries trained in this area (at multiple scales: farmer, extension, researchers, students, other stakeholders) • Number of partnerships, extension services that supported demand-driven, labour-saving and gender-sensitive research products to reduce drudgery while increasing labour efficiency in the production	• Research products and recommendations data bases (CKAN) • Extension briefs (AR report, wiki) • Research articles (AR reports) • Training reports • Policy briefs (AR reports) • Partnership agreements (AR program reports)	• Demand for technologies, recommendations and research products have been developed • Resource (human and financial) flow is maintained • Government support - political will and policy

	cycle • Percentage of adoption on gender-sensitive technologies and associated research products		
Output 1.3: Tools (including ICT-based) and approaches for disseminating recommendations in relation to above research products, integrated in capacity development [and used in Outcomes 4 and 5]	• Numbers of protocols for novel dissemination approaches developed; • Number of training materials developed	• Protocols and materials on CKAN	
Project Outcome 2: Natural resource integrity and resilience to climate change enhanced for the target communities and agro-ecologies	• Percentage farm area under enhance natural resources management (NRM)	• Survey report (CKAN) • AR Project Report (CG Space) • USAID Country level Quarterly Reports	• Donor support remains sustained • Target areas remain conflict free • Extreme events do not impact target areas (e.g. Fires, floods, droughts)
Output	Objectively verifiable indicators	Means/source of verification	Important assumptions
Output 2.1: Demand-driven research products for enhancing soil, land and water resources management to reduce household/community vulnerability and land degradation piloted in priority agro-ecologies [and scaled in Outcome 5]	• Percentage of households trained on the use of demand-driven research products to enhance soil, land, and water resources management	• Project Reports (field visits, surveys, RRA, PRA, Participatory evaluations) • NARS Bi-annual Reports • Newsletters, , AR website • Videos, podcasts, blogs, publications, case studies and photo-films	
Output 2.2: Innovative options for land and water management in	• Number of demonstration and training sites	• Project Reports	• Platforms are supported by local governments

selected farming systems demonstrated at strategically located learning sites [and scaled in Outcome 5]	• Number of innovative options (by type) for land and water management system demonstrated • Functional innovation platforms established/strengthened	• NARS Annual Reports	
Output 2.3: Inclusive approaches and methods for collective action to deliver innovative water, soil and land resources management piloted in target communities [and scaled in Outcome 5]	• Number of approaches (by type) and methods • Number of stakeholders reached with innovative approaches/methods	• Project Reports (field visits, surveys, RRA, PRA, Participatory evaluations) • NARS Reports • Videos, podcasts, blogs, publications, case studies and photo-films	
Project Outcome 3: Food and feed safety, nutritional quality, and income security of target smallholder families improved equitably (within households)	• Percentage of food/feed produced/marketed and consumed that have contaminant levels below the safety limits • Percentage change of households diversifying their diets • Percentage change of children under 2 to 5 able to meet the minimum acceptable diet • Percentage of households with reduced expenditure on food	• Publications on food/feed safety interventions • Food/feed analysis reports (CKAN) • Household/nutrition survey reports CKAN) • Household expenditure/economic survey reports (CKAN)	• Donor support remains sustained • Target areas remain conflict free • Extreme events do not impact target areas (e.g. Fires, floods, droughts) • Farmers willing to participate
Output	Objectively verifiable indicators	Means/source of verification	Important assumptions
Output 3.1: Demand-driven research products to reduce postharvest losses and improve food quality and safety piloted in target areas [and scaled in Outcome 5]	• Number of research products (farmer approved varieties, technologies and their associated recommendations) assessed to reduce postharvest losses and improve food quality	• Postharvest loss assessment report • Adoption studies • Qualitative studies on barriers/enablers to post harvest technologies	• Farmers are willing to invest in technologies for postharvest reduction

	and safety • Number of partners trained for piloting in targeted areas	• BTT report by IFPRI (on CKAN) • Research publications	
Output 3.2: Nutritional quality improved through increased accessibility and use of nutrient-dense crops and livestock products	• Percentage change of households with access to nutrient-dense crop and livestock products through own production or purchase • Percentage change of households incorporating nutrient dense crop and livestock products into their diets	• Food and nutrient analysis reports • Household nutrition survey reports • Food and feed safety assessments • Acceptability studies report • BTT report by IFPRI (on CKAN) • Research publications	• Farmers willing to adopt nutrient dense foods • Markets are available for access to nutrient dense foods
Output 3.3: Capacity of farming communities and partners to consume nutrient-dense crops and livestock product enhanced.	• Percentage change of farm families consuming dense crop/fodder species • Percentage of local partners promoting dense crop/fodder species • Number of trainings for partners and farmers in use of decision support tools	• Adoption study reports • Qualitative studies on barriers/enablers for diverse crop/fodder production and utilization • Research publications	• Farmers and partners willing and able to participate
Project Outcome 4: Functionality of input and output markets and other institutions to deliver demand-driven sustainable intensification research products improved	• Increased share of crop and livestock products marketed • Percentage change of household income • Percentage of households (including all gender groups and the youth) accessing market information	• Household and market survey reports (on CKAN) • Project monitoring reports	• Willingness of market actors to share data • Conducive political environment prevails

	• Percentage change in productivity • Percentage change in inputs (seeds, fertilizer, manure, pesticides) marketed		
Output	Objectively verifiable indicators	Means/source of verification	Important assumptions
Output 4.1: Access to profitable markets for smallholder farming communities and priority value chains facilitated	• Number of market linkages developed • Number of farmers linked to end markets	• Monitoring report	• Willingness of market actors to share data • Stakeholders are willing to cooperate • Enough market demand
Project Outcome 5: Partnerships for the scaling of sustainable intensification research products and innovations operationalized	• Number of partnerships established for the scaling of sustainable intensification research products and innovations • Percentage change of indirect beneficiary • Percentage change in uptake of technologies by indirect beneficiary	• IFPRI mid and end term surveys (on CKAN)	• Development actors willing to invest in dissemination of Africa RISING research products
Output	**Objectively verifiable indicators**	**Means/source of verification**	**Important assumptions**
Output 5.1: Opportunities for the use and adoption of sustainable intensification technologies identified for relevant farm typologies	• Number of innovations redesigned based on farmers' feedback and regular economic, social and gender analyses • Number of policy recommendations made to support adoption and scaling • Social, institutional and economic constraints and opportunities for	• Project monitoring and review reports • Policy briefs (on CKAN) • Repositories of local administration	• Agriculture remains a local development objective • Partners remain committed to engage in project implementation

	technology adoption		
Output 5.2: Strategic partnerships with public and private, initiatives for the diffusion, and adoption of research products established	• Number of new partnerships, learning alliances, ips, and knowledge sharing centres formed for technology and knowledge delivery and dissemination • Number of learning events conducted involving different stakeholder	• Project monitoring and review reports • Partner reports • New mous signed with partners (PROMIS) • Learning event reports on AR wiki	• Stakeholders willing to share knowledge and technology along the value chain • Other complementary development agencies and partners continue to invest and support agriculture led growth
Output 5.3: Gender-sensitive decision support tools for farmers to assess technology-associated risk and opportunities used by partners	• Number of gender-sensitive decision tools developed and tested • Number of partners (by type) trained in the use of the decision support tools • Number of partners (by type) using the decision support tools to guide adoption	• Project monitoring and review reports • Partner reports	• Gender inclusiveness remains focus area for investments by governments and partners
Output 5.4: A technology adoption, monitoring, evaluation, and learning framework for use by the project team and scaling partners released [led by IFPRI and used by project partners]	• Number of frameworks (by type) released • Number of scientists using M & E tools to track adoption • Number of scientists using this information to modify technology delivery/pathways. • Number of partners/institutions participating in learning alliances	• Project monitoring and review reports • Partner reports	• Partners remain committed to invest and sustain R in D in agriculture
	•	•	•

END.