Sustainable intensification of maize-legume-livestock integrated farming systems in Eastern and Southern Africa

DRAFT CONCEPT NOTE

IITA

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1. **Background**

Feed the Future (FtF) Tanzania is focusing on reducing poverty and improving nutrition through key investments to improve availability and access to staple foods by enhancing the competitiveness of smallholders in rice, maize and horticulture value chains; raising productivity through irrigation and rural roads; improving household nutrition; policy reforms; and developing national capacity for policy, planning and coordination, research and development and monitoring and evaluation (U.S. Government, 2010). These investments are being geographically focused in areas with high agricultural potential bordering chronically food insecure districts: Morogoro (rice); Manyara and Dodoma (maize); and Arusha, Kilimanjaro, Tanga, Zanzibar, Dar es Salaam, Morogoro, Iringa and Mbeya (horticulture). Nutrition interventions are being focused in areas with high chronic malnutrition such as Dodoma region. The FtF target areas are characterized by moderate to high levels of food insecurity and poverty, but with high potential for growth. To target these geographic areas, FtF used several criteria. These include proximity to transport corridors for market access and impact on nearby food insecure areas; lack of investment by other donors; water resources and climatic conditions for the value chains; opportunity for high impact on "productive" poor; areas prioritized by Government of Tanzania and private investors; and ability to achieve scalable high growth impact in focused areas.

The global FtF is focusing on sustainable intensification of farming systems in eastern and southern Africa (U.S. Government, 2011). The program is complementing FtF vestments in Tanzania with research on best-bet management practices for sustainable intensification. This is focusing on livestock integration with maize and legumes, complementing and expanding the existing activities under the Sustainable Intensification of Maize-Legume Cropping Systems for Food Security in Eastern and Southern Africa (SIMLESA) led by CIMMYT, ICRISAT and partners in five countries, including Tanzania, Malawi, and Mozambique. This will also have linkages to the CIMMYT, IITA and ICRISAT initiatives in maize and legume systems in Eastern Zambia supported by USAID-Zambia.

This research is to improve components of the agricultural production system around the value chains targeted by FtF in order to expand the productivity and resilience of multiple system components though a systems-based, multi-disciplinary, multi-centre approach to improving the livelihoods of poor rural households in these two regions of Tanzania. This will focus on livestock integration with maize, legumes and vegetables, taking into consideration the effects of climate change in the target regions.

There is an increasing consensus that increasing food production in the African countries requires sustainable intensification because of the high population growth, rapidly changing consumption patterns and the impacts of climate change and environmental degradation (Pretty et al., 2011). Sustainable agricultural intensification is defined as producing more output from the same area of land while reducing the negative environmental impacts, and at the same time increasing contributions to the natural capital and the flow of environmental services.

Sustainable agricultural intensification requires coordination of different research products and investments among multiple donors, regional organizations, universities, farmers' associations, private sector firms, national and international agricultural research institutes and non-governmental organizations (NGOs). The Consortium of International Agricultural Research (CGIAR) Centers and partner institutions are implementing CGIAR Research Programs (CRPs) to apply international agricultural research to better achieve development impacts on poverty reduction, increased food security, improved human nutrition and health and enhanced natural resource management. The systems CRPs -- CRP 1.1 Integrated Agricultural Production Systems for the Poor and Vulnerable in Dry Areas and CRP 1.2 Integrated Systems for the Humid Topics -- are focusing on the integration of components at the level of the farming systems for sustainable intensification of agricultural production systems. The systems CRP regional research activities complement the FtF focus on sustainable intensification and provide a framework for scaling up and scaling out technological, institutional, market and policy innovations and models through broadening partnerships and linkages to other country-based FtF programs in Malawi and Zambia.

This concept note proposes to use agricultural production systems research to build on the SIMLESA research approach for sustainable intensification of maize-legume-livestock systems in Eastern and Southern Africa. Research will be carried out to develop, evaluate, test and deliver to smallholder farmers in the areas targeted under the FtF program integrated production systems production technologies, market and institutional and policy innovations that are appropriate to varying ecological, market, social and cultural contexts. These could include systems options for integrating component genetic and production technologies, systems diagnostic tools, models and decision support tools, value chain approaches for linking smallholders to markets with more profitable opportunities and context specific institutional and policy innovations.

2. Overall goal, purpose, objectives and outputs

The overall goal is to sustainably increase agricultural productivity growth, economic growth, food production, food and nutrition security and improve natural resource management in order to reduce poverty and hunger in the target FtF areas in Tanzania and in the eastern and southern Africa region.

The purpose is to increase the productivity of maize-legume-livestock production systems, system resilience and agro-ecosystem services including provisioning of food and feed; improved water and soil conservation, soil nutrient supply and cycling, soil health and soil structure; carbon sequestration and biodiversity; and adaptation to climate variability and change.

The specific objectives and outputs are:

- Participatory diagnosis, characterization of agro-ecologies, farming systems, household typologies, land use, marketing and gender systems and setting of research priorities
- Integrated options for assembling crop, agro-forestry and livestock genetic technologies and production systems for sustainable intensification
- Integrated options for value chains, institutional and policy innovations for sustainable intensification
- Market and institutional options for scaling up and scaling out sustainable intensification.

3. Geographic focus

Dodoma and Manyara Regions in Tanzania are the geographic focus of the FtF project, thus for this project. These areas are located in the Southern Agriculture Growth Corridor of Tanzania. Dodoma Region is a region centrally positioned in Tanzania. This Region is bordered by Manyara Region in the North, Morogoro in the East, Iringa in the South and Singida in the West. Much of the region is a plateau rising gradually from some 830 metres. There are three agro-ecological zones in this region. Zone I includes the drier areas with 300-500 mm. This agroecological zone covers most of the Manyara region and the Masai Steppe in Northeast part of Kondoa, Southern part of Dodoma Rural and Southwest part of Mpwapwa District. The area is dominated by dry, flat or undulating plain with low population. Rainfall is very unreliable. The soils are mostly reddish-brown loamy sands with grey clays in depressions. Major crops in these areas are sorghum, pearl millet, cassava, sweet potatoes, groundnuts, simsim, grapes, *Lablab purpureus* and sunflower. Potential legume crops include pigeon pea, and cowpea. Potential vegetable crops include African eggplant, Ethiopian mustard, African nightshade, amaranth and vegetable cowpea

Zone II has rainfall of 500-700 mm. It covers central and southern part of Kondoa District, Northern part of Dodoma District, the whole part of Kongwa District and part of Mpwapwa. The area has dark-brown and dark-reddish loamy sands. Major crops are maize, sorghum, groundnuts, grapes, sunflower, cassava, and simsim. Cowpea, tepary (*Phaseolus actufilius*) and pigeon-pea are legumes with high potential. Ethiopian mustard, African nightshade and vegetable cowpea are vegetables with high potential.

Zone III has better rainfall of 700mm-1000mm. It covers the central part of Mpwapwa District and the Bereko highlands in Kondoa District. This area has deep dark-reddish brown clay loams and black-clay soil in depressions and valleys. Major crops are maize, sunflower, grain legumes, vegetables and bananas. The region is suitable for cowpea, soybean, pigeon pea and beans. Tomato, African eggplant, Ethiopian mustard, African nightshade, amaranth, vegetable cowpea, jute mallow and spiderplant are among vegetable crops with a significant potential in this region. Major constraints (biotic and abiotic) to crops and farming systems are drought, changing rainfall patterns and temperature, inherent low soil fertility, parasitic weeds (*Striga* sp. for cereals and *Alectra vogelli* for cowpea) insects and diseases. Insects include stalk borers for maize and sorghum; pod sucking insects for cowpea and pigeon pea; aphids for cowpea, Ethiopian mustard and spiderplant, and common bean; and white flies and begmoviruses for tomato. Diseases include fusarium wilt for pigeon pea and tomato; fusarium and verticilium wilt for African eggplant; anthracnose for common bean; late blight for tomato; and soybean rust.

Livestock is important, including cattle, goats and sheep. Poultry and pig farming for commercial purposes are mainly confined to urban market centers. Local chickens abound and are in high demand in the Dar es Salaam market. The central region of Tanzania is marginal for crop production and with climatic change its ‘reliable crop growth days’ may decline to less than 90 per year (Jones and Thornton, 2009). Consequently, livestock will play a key role as an important source of income for smallholder farmers. Besides, farmers can exploit the short growing period of leafy vegetables (some maturing in just 21-30 days) and more efficiently utilize short flushes of rain. The parts of vegetables not sold or used for human food can be used for livestock feed.

Food shortage is common in most households. Presently, food security conditions in Manyara have deteriorated in the north and north-east, particularly in Simanjiro due to the effects of drought. This has affected many pastoralist and agro-pastoralist households.

The selection of actual action research sites within the above geographic focus will be done at a later state under the leadership of the HarvestChoice team of IFPRI.

4. Links with on-going research

The proposed project links and matches with existing research being conducted in these agro-ecologies and farming systems. IITA, CIMMYT, ICRISAT, CIAT, ICRAF, AVRDC, ILRI and international and national partners have developed high-yielding, drought tolerant and risk-reducing maize, sorghum, millet and legume, agro-forestry, vegetables and forage legume varieties as well as productivity-enhancing and climate change mitigation technologies for rain-fed maize-legume systems characterizing Dodoma and Manyara. For example, the Drought Tolerant Maize for Africa (DTMA) project developed several stress tolerant open-pollinated varieties (OPVs) maize and hybrids. IITA has developed lowland OPVs or hybrids with a range of maturity periods that combine drought tolerance and Striga resistance/tolerance. Similarly, CIMMYT has developed imidazalinone-resistant (IR) maize OPVs/hybrids that offer resistance to Striga. These various germplasm can be potentially deployed in the affected regions. In addition to maize, IITA has developed Striga/Alectra-resistant cowpea varieties and soybean varieties that fix large amounts of atmospheric nitrogen that can be made available to the associated cereal crops. The soybean varieties have been shown to cause suicidal germination of Striga when grown in rotation with cereals, thereby reducing Striga infestation. These technologies have been widely tested and promoted in the West Africa savannas. CIAT-TSBF has developed a range of best-bet Integrated Soil Fertility Management (ISFM) technologies (Vanlauwe et al., 2011). AVRDC in collaboration with national partners has developed and released several improved varieties of tomato and indigenous vegetables. These now need participatory evaluation and promotion in maize-legume systems of Tanzania.

In addition to generic research on crop improvement and better natural resource management that is likely to be relevant to these two regions, ICRISAT is currently working in Babati and Mbulu districts of Manyara region and in Kondoa, Bahi, Chamwino, Dodoma Rural and Dodoma Urban districts of Dodoma region (groundnuts, pigeonpea, maize/pigeonpea intercropping and starter doses of phosphate). CIAT-PABRA and the Tanzania Bean Research based at Selian Agriculture Research Institute (SARI) of the Northern Zone have developed high-yielding micro nutrient dense bean genotypes that are appropriate for maize-legumes-livestock intensification systems. Under TLII project, SARI bean programme with CIAT-PABRA support has identified promising drought tolerant/early higher-yielding maturing bean varieties of various locally preferred market classes (red mottled, purple-kablanketi, red kidney and yellows). There is a need to widely test these lines with farmers and other end users in the supply chain particularly traders. These bean varieties may fit well in both rain fed intercropping with maize and as well as in rice–legumes rotation cropping systems using residual moisture. This is because they are more water efficient and mature early. Trials have been conducted to test the effect of Minjingu phosphate rock. AVRDC in collaboration with local partners is testing the viability of alternative seed multiplication and distribution schemes in Arusha and Dodoma. There is a need for wider testing under farmers' conditions.

ILRI has developed crop residue management feed technologies for livestock. The Center is developing rapid assessment tools for diagnosing livestock constraints in rural systems. Tanzania is a focal country for development of the dairy value chain under CRP 3.7 More Milk, meat and fish, for and by the poor. A number of new dairy projects are starting in the Southern Highlands of Tanzania. ICRAF has developed agro-forestry technologies such as rotational woodlots and boundary tree planting for restoring degraded soils and for enhancing food crops and fodder production in Shinyanga and Morogoro Regions. Recent work by ICRAF has also demonstrated that maize yield fluctuations resulting from climate induced rainfall and temperature variability can be mitigated by strategically combining food crops, legume trees and supplemental fertilization to increase rain water use efficiency and soil fertility. These interventions can be extended to Dodoma and Manyarato address soil nutrient and moisture limitations to agricultural productivity and to enhance livestock feed supply and landscape management. CIAT has developed drought-tolerant food/feed legumes (e.g., *Lablab purpureus*, cowpea, pigeon pea) forage legumes (e.g., *Canavalia brasiliensis*) and (multipurpose) fodder shrubs and trees. IITA and ILRI have developed dual purpose (food/feed) cowpea systems in similar ecologies in western Africa that can be tested in the geographic targets of this project. These complement the supply of crop residues available for livestock.

Aflatoxins are a major problem for many crops. For instance, a significant amount of the harvested maize grain is contaminated with aflatoxins. These are among the most potent human carcinogens (Wild and Turner, 2002). Chronic exposure to aflatoxin leads to immune suppression and associated susceptibilities to opportunistic diseases (Jiang et al., 2008). Poor drying and storage of maize increases aflatoxin contamination, pest attack (especially weevils) and results in high post harvest losses of up to 30% and poor quality grain. Aflatoxin contamination can be reduced through breeding maize for reduced aflatoxin contamination and use of biopesticides. IITA has developed a biological control product named Aflasafe™, which contains a mixture of four atoxigenic strains. Aflatoxin contamination is reduced by 60-96% when maize fields are treated with Aflasafe™. Efforts will be made to expand the use of this product in Tanzania. CIMMYT has identified breeding materials with resistance to the ear rots and the mycotoxin-producing fungi (including *Aspergillus flavus* and *Fusarium* spp.). These complement the biocontrol technology developed by IITA. In addition, the metal silo technology (a low-cost grain storage technology) promoted by CIMMYT in ESA has the potential to enhance food safety and security to the smallholders in Tanzania. Food saved from storage pests is food produced. This creates incentives for farmers to participate in markets and to invest in sustainable practices.

The toxicity of aflatoxins to humans and animals has led to regulatory controls on trade of contaminated crops, particularly for export markets. Successful management requires capacity building among farmers and traders in post harvest handling as well as cheap and easy methods to test for levels of contamination. ICRISAT has developed simple test kits for use on groundnut and other crops.

CGIAR Centers are currently focusing on moving different research components and products from research to dissemination independently among different organizations and development interventions. Consequently they are failing to exploit strategic complementarities and synergies among farm productivity, access to agricultural input and output markets and sustainable natural resource management (Lynam, 2007). The proposed research adds value to on-going research by integrating currently fragmentary and diverse research products and development interventions among different organizations. This will permit better exploitation of competencies and capabilities through spatial alignment in agroecologies where poverty reduction is highest and better translate system research outputs into adoption and development impact. This will contribute to achieving the FtF objectives and goals.

5. Sustainable intensification: Conceptual framework, research areas and activities

Several conceptual frameworks exist for analyzing the relationships between the complex interventions at the level of farming systems and the underlying impact pathways; generating hypotheses; and guiding data collection and testing of hypotheses on what is really needed for the systems in question to intensify sustainably. These range from the Benchmark area approach championed by CGIAR in the 1990s (Douthwaite et al., 2005), Integrated Natural Resources Management (INRM) approach developed in Penang, Malaysia in 2000 through the commodity by value chains by NRM model to the current approach on Agro-ecological Intensification (AEI). The INRM framework was developed to add the sustainability agenda to the farming systems research and the Green Revolution approaches (Lynam, 2011). INRM emphasizes the linkages between participatory problem analysis, INRM research on alternative solutions, production functions, human well-being, ecosystem functions, tradeoffs and options, outcomes and feedbacks (Task Force on INRM, 2000). The agro-ecological intensification approach has been developed to add climate change (system resilience) and ecosystem services to the INRM approach. AEI uses the genotype by environment by management by landscape by markets framework as a laboratory to locate research within the context of drivers of change in agriculture, farming systems, agro-ecological heterogeneity, system dynamics, and short-term and long-term time horizons (Lynam, 2011). AEI links natural resources dynamics with farm household incomes/food security/poverty through integrating sustainable NRM-based production technologies, trees and livestock into production systems as well as institutional and policy innovations at farm, landscape, watershed, national and global levels. The most appropriate conceptual framework for addressing the research questions will be evaluated during the diagnostic phase of the project.

The research is proposed to be implemented in a sequence of activities starting with participatory diagnosis through participatory development of integrated options, testing the effects of various options on productivity, farm level outcomes and ecosystem integrity and analyzing risk-return trade-offs among different options and trajectories, monitoring, evaluation and impact assessment. The research will be organized into five main areas spanning the sequence of stages of activities involved in moving system research outputs to development impacts.

Research Area 1: Participatory diagnosis, characterization of agro-ecologies, farming systems, household typologies, land use, marketing and gender systems and setting of research priorities

Enhancing the impact research on maize, grain and tree legumes, vegetables and livestock technologies and institutional and policy innovations in Tanzania and spillovers to Malawi and Mozambique requires better characterization and targeting of the production systems and solutions for addressing key socioeconomic and policy constraints that limit farmer (especially women's) access to new technologies, including access to seeds, fertilizer as well as credit to finance these investments. Farmers also need access to output markets and effective grain storage and processing methods to enhance their incomes. Access to technology is not always scale or gender neutral as well and some members of the community may lose in the process. Previous studies have particularly shown that small-scale farmers (less than 2 ha) and women farmers lag behind in adoption of improved technologies. Women provide about 60% of the family labor used in agriculture but mainly manage smaller plots for family food security. Since average farm size is only 2.4 ha in Dodoma and only 2.1 ha in Manyara (National

Bureau of Statistics, 2007 a, b) that implies that more than half of all target farmers are likely to farm less than 2 ha. Therefore the project will develop a targeting strategy for technological interventions that is particularly appropriate for these smallholders and avoids farmer ‘overload’ while preserving the ‘integrated’ ethos of the project.

However, there is little reliable information as to the reasons and household level challenges for the poor maize-legume-livestock integration and the gender, market and institutional constraints that determine farmers’ technology choice. In order to guide efficient interventions to improve the productivity and reduce the risks faced by smallholder crop-livestock producers, a systematic evaluation of the major constraints and diagnosis of system improvement options will be undertaken during the startup of the project to inform and support field testing of integrated systems innovations in target communities. The studies will be conducted at the beginning of the project to generate data for characterization of the agro-ecologies, farming systems analyses and household typologies, input and output marketing and gender systems; and to benchmark system technologies and practices targeted under the research; and current levels of adoption of the technologies and practices; and assess comparable geographical areas for extrapolating results in Malawi and Mozambique. The characteristics of the agro-ecologies, farming, land use, marketing and gender systems and household typologies will be used to set priorities for the research interventions and to select research action sites.

Proposed activities

I. Conduct socioeconomic and biophysical characterization and GIS-based mapping of target maize-legume-livestock farming systems to identify the key drivers of change and development pathways

II. Carry out baseline surveys and analysis to understand farmers’ maize, legume, agroforesty, and livestock production constraints and opportunities, crop and livestock interactions, resource use, technology preferences, land use and land cover, market access and gender dimensions in the target farming systems

III. Identify, develop, test and promote options for improving seed and input delivery systems and output markets and value chains including chain constraints and opportunities, costs and pricing patterns for maize, legumes and livestock products

IV. Develop and apply bio-economic and simulation modeling for selected farm-household typologies to define system options (and tradeoffs) that reduce risks and enhance profitability

V. Carry out ex-ante impact assessment of research interventions prior to their implementation and setting of priorities on research areas and pilot action sites and areas in Malawi and Mozambique for scaling out results.

Research Area 2: Integrated options for assembling improved crop, agro-forestry and livestock genetic technologies and production systems for sustainable intensification

This research area will be organized around maize-legume-agroforestry-livestock systems initially with issues of which varieties of maize, legumes, agro-forestry and breeds of livestock are appropriate. Past crop and livestock management research has developed component management technologies that can be assembled with genetic and sustainable NRM practices into integrated production systems technologies for crop, agroforestry and livestock. For example, systems technologies include push pull, assemblages of crops and conservation management for sustainable intensification, integrated crop management (soil water, nutrient and pests), post harvest and storage management, and integrated livestock feed and health management. Diversification with ‘longevity legumes’ that provide some grain while at the same time extending capture of sunlight and nitrogen fixation (e.g., agroforestry and multipurpose pigeonpea, indeterminant mucuna, soybean and cowpea), are technologies have been shown to support enhanced fertilizer efficiency, and gains in grain production (quantity and quality), as well as stability of production in a variable climate (Snapp et al., 2010). Participatory field-testing and adaptation of best-bet options will support technologies being evaluated and adapted, to improve and assess for their feasibility, practicality, profitability, riskiness, adoptability and sustainability for differently resourced-farm households in different agro-ecological, market, social and cultural environments. Synthesis of best bet technology iterative testing will be conducted to develop ‘better bet’ options as recommendations for broader dissemination.

Proposed activities

I. Carry out participatory evaluation of promising crop genotypes and breeds of livestock across agro-ecologies and farming systems for adaptation and other end user traits
II. Following a constraints analysis, carry out participatory evaluation of promising integrated best-bet production systems technologies for crops-agroforestry-livestock (eg., planting date, spacing, soil water and nutrient management, seed priming, seed dressings, fertilizer, rhizobium inoculums, intercropping systems, mechanization, smart feeding strategies which better combine cereal residues with high quality feeds including legume residues and green forages) that optimize systems productivity and profitability

III. Identify economically viable options for postharvest management and improving food safety (e.g. use of simple test kits to quantify levels of contamination; Aflasafe and other complementary technologies (including host-controlled resistance and metal silos) for significantly reducing aflatoxin contamination in maize)
IV. Produce breeder and foundation seed of varieties that have farmer and end-user preferred traits
V. Synthesize better bet management options and recommendations for assemblages of improved crop varieties and animals, combined with targeted input use
VI. Develop integrated recommendations that support nutrient use efficiency, labor savings and yield (quality, quantity and stability) for profitable production
VII. Develop, test and evaluate dissemination tools (flyers, radio programming, educational training materials etc) and extension approaches to support farmer innovation around better bet options and preferred varieties.

Research Area 3: Options for value chains, institutional and policy innovations for sustainable intensification

This research area will focus on value chain and institutional and policy analyses for the farming system intensification to generate synergies for farmers related to market opportunities in order for them to capture more value and support the shift to sustainable intensification. Value chain research work will focus on identifying, designing, testing, evaluating and promoting improvements in agricultural value chains especially for maize and horticulture. The adoption studies will be carried out in partnership with the M & E system led by IFPRI.

Proposed activities

I. Identify, design, implement, monitor and evaluate strategies across prioritized value chains
II. Identify, design, implement, monitor and evaluate institutional innovations to support the sustainable agro-ecological intensification of farming systems and development of the value chains
III. Identify, formulate, implement, monitor and evaluate policy innovations to support sustainable agro-ecological intensification of farming systems and development of value chains
IV. Carry out adoption surveys of integrated production systems technologies for crops, agroforestry and livestock during the initial diffusion period
V. Assess the value chain, institutional and policy investments that support the system shift to sustainable intensification

Research Area 4: Market and institutional options for scaling up and scaling out sustainable intensification

This research area will analyze the pathway of farming systems intensification, evaluate innovation approaches that support system change within the sustainable intensification process and evaluate the ex-post impact assessment of the research interventions and approaches for scaling up and scaling. This work will be carried out in partnership with the M & E system led by IFPRI.

Proposed activities

I. Carry out participatory mapping of input-activity-output-outcome-impact pathways and farming systems intensification pathways
II. Monitor and evaluate promising integrated production systems technologies for crops-agroforestry-livestock against technical criteria under on-station and on-farm conditions
III. Carry out ex-post impact assessment and assess what works, when, why, for whom and for how much
IV. Develop simulation models and assess scalability to different settings
V. Integrate participatory testing with modeling, in conjunction with research area 2 activities to support synthesis of findings on ‘better bet’ options; and to develop recommendations for a range of agroecological zones and socioeconomic groups
VI. Develop methodological templates for scaling up and scaling out interventions and/or results in Tanzania and in comparable pilot sites in Malawi and Mozambique.

6. Capacity Building

This project will pay great attention to capacity building by involving graduate students at MSc and PhD levels. Each Research Area will target at least two graduate students. In addition postdoctoral researchers will be involved to implement most of the research activities. Group trainings on specific topics and tools will be organized as needed to ensure the efficient implementation of the project. The topics of these group trainings will be determined during the preparation of the full proposal and all levels of training will be considered from farmers, lead farmers, agro dealers, field and lab technicians, extension agents, scientists and policy makers. These will be carried out in collaboration with US and African universities and other training institutions. For example, two graduate students and one postdoctoral fellow working in collaboration with Michigan State University have been identified to work on agroforestry and conservation agriculture.

7. Monitoring and Evaluation

Monitoring and Evaluation (M&E) in this project is made of two parts. The first part is under the supervision of HarvestChoice of IFPRI. The M&E activities are designed to achieve a number of goals:

- **FtF Compliance:** To conform to the overarching M&E standards, best practices, and core indicators established for the entire FtF initiative (e.g. USAID 2011b)
- **Open-access platform:** To deliver and maintain an open-access M&E data management and analysis platform to serve the needs of SI stakeholders
- **Backward & forward assessment:** To provide monitoring reports for *and* ex ante projections of agreed M&E indicators on an annual basis to meet stakeholder reporting and planning needs. This will support iterative learning and adaptation to local needs, as a foundation for broad adoption of technologies and approaches.
- **Multi-scale reporting:** To meet various stakeholder needs, and to support multi-scale analysis, the M&E platform will report at several scales; (SSA wide, site wide, country, sub-system reports).
- **Scaling-up and out assessments**: To inform planning and long-term projections of potential impact.

Proposed Implementation Approach

The M&E activities will be coordinated by the HarvestChoice team at IFPRI. The spatial evaluation framework encompasses nationally representative household survey data as well as biophysical, production, market, demography and infrastructure data. These elements form the core of a consistent M&E platform to be applied across not only the target farming systems within the Eastern/Southern Africa megasite, but also across all three FtF Sustainable Intensification (SI) megasites in SSA. By design the current platform has a high degree of spatial and system granularity to support disaggregated examination of farming sub-systems, household types and key ecosystem services. But the platform needs to disaggregate further or interface with higher resolution capacities of implementation partners within specific sites still needs to be established. This core capacity will, thus, be augmented to assimilate richer location and intervention-specific data from field-based activities of the SI partners. This will include carrying out specialized, supplementary M&E surveys.

Several important organizational and management principles will be adopted:

- **M&E Alliance:** A core advisory team of M&E and key stakeholder specialists to guide and provide internal review of the M&E work plans and deliverables.
- **M&E Open-Access Web-Site:** To host and make accessible SI project documents and work plans, as well as M&E technical notes and annual reports, and underpinning background publications, datasets and, wherever possible, analytical tools.
- **Annual M&E Technical Meeting:** Prior to finalization of each annual suite of M&E reports, a technical consultation will review findings and distill M&E-based recommendations. Where possible this will build on other project meetings to minimize travel time and project costs.

Analytical Approaches and Deliverables

There are at least four data and analytical aspects of the M&E evaluation capacity: (i) Delineation and characterization of target farming systems, (ii) Maintenance of a technology/intervention characterization inventory, (iii) Baseline and change assessment/projection for core M&E indicators, (iv) Change attribution. Coupled with the data management and access, report generation, and broader outreach activities, these analytical elements constitute the principal elements of the M&E logframe.

The specific details of M&E activities, outputs and responsibilities will be determined in the first three months of the project, and will largely be shaped by both technical consultation with partners (e.g. the February 2012 project design meeting in Tanzania), as well as with donor-specific M&E, impact and attribution needs.

Performance monitoring

The second part of M&E is internal to the management and corresponds to performance monitoring of the project. Performance monitoring is a project management function involving monitoring of project inputs, activities, outputs, and milestones. Both internal and external evaluations will be conducted as well as for regular progress reports to stakeholders. The performance monitoring will ensure that inputs are used accordingly to plans and that the project achieves the expected outputs. All milestones will be tracked down for timely delivery. Performance monitoring will be extended to all the partners linked by sub-contracts to this project. At the inception of the project, there will be a launching meeting where all stakeholders will attend. At the end of every year, there will be general meetings to review progress and produce work plans for the following year. The project management will submit regular reports to donors as specified in the contract. External evaluations will be conducted according to donors' plans. All the reports will be archived and stored in a database for future uses.

8. **Project management and coordination**

Overall responsibility for project delivery, budgetary control and reporting to USAID will lie with the lead center, IITA, through the Project Coordinator. The Lead Center will establish a performance contract with USAID.

The development of this concept note has been a collaborative effort between IITA, CIMMYT, ICRISAT, ILRI, CIAT, ICRAF, AVRDC, IFPRI and MSU. These organizations are primary project partners.

A Project Steering Committee (PSC) will provide overall policy guidance, approve annual work plans and budgets, monitor progress and approve significant changes in activities during implementation period to ensure timely achievement of the objectives. The PSC will consist of representatives of CG centers, the Lead Center (IITA), the Project Coordinator, USAID FtF Tanzania, USAID Washington, the Ministry of

Agriculture, Food and Cooperatives of Tanzania, and stakeholders' in the target areas. The PSC will meet regularly or when need arises in a virtual manner.

At the end of each implementation year, a workshop with partners and relevant collaborators will be conducted to assess project progress, address constraints and plan for the next year of implementation (see above *Performance monitoring*).

The Project Coordinator will manage the project on a daily basis. The Coordinator will monitor and oversee implementation of Task Force sub-projects that have received grants for implementing project activities. The Project Coordinator will conduct half-yearly visits to all sites to review progress. The Project Coordinator will collate and synthesize M & E reports as needed for internal monitoring of project progress in order to ensure that all milestones are timely achieved (see above Performance monitoring). The Coordinator will be supported by IITA administrative staff in Tanzania.

The research team will be organized into Task Forces around the four research areas. Each Task Force could be led by one of the CG centers that participated in the Planning Meeting in Addis Ababa, Ethiopia, held from 16-17 October 2011. The Lead Center, IITA, will establish performance contracts and sub-grants with the Centers that lead the Task Forces.

Each Task Force will identify and mobilize key stakeholders, establish a research team, develop work plans and budgets and implement the research. The Centers that lead the Task Forces will sub-contract key stakeholders as needed and report technical and financial progress on a quarterly basis to the Lead Center through the Project Coordinator for transmission to the PSC and USAID.

9. Timeline *(1/4page)*
(all)

10. Budget Summary *(table, ½ page)*
(all)

References

Douthwaite, B., Baker, D., Weise, S., Gockowski, J., Manyong, V. M. and Keatinge, J.D.H., 2005. Ecoregional research in Africa: learning lessons from IITA's Benchmark Area Approach. Experimental Agriculture, 41 (3): 271-298.

Jiang, Y., Jolly, P., Preko, P., Wang, J.S., Ellis, W.O., Phillips, T.D., 2008. Aflatoxin-related immune dysfunction in health and in human immunodeficiency virus disease. Clinical and Developmental Immunology, 1-12.

Jones, P.G, Thornton, P.K., 2009. Croppers to livestock keepers: Livelihood transitions to 2050 in Africa due to climate change. Environmental Science & Policy 12: 427-437..

Kimaro, A.A, Timmer, V.R., Chamshama, S.O.A., Ngaga, Y.N, Kimaro, D.A., 2009. Competition between maize and pigeonpea in semi-arid Tanzania: effect on yields and nutrition of crops. Agric. Ecosyst. Environ. 134: 115-125.

Lynam, J., 2011. Translating system research into farmer adoption. Paper presented at the CIALCA International Conference "Challenges and Opportunities for Agricultural Intensification of the Humid Highland Systems of Sub-Saharan Africa", Kigali, Rwanda, 24-27 October 2011.

Lynam, J.K., 2007. Research into development: Assessing CGIAR research priorities from the perspective of development challenges. <http://www.cgiar.org/changemanagement/pdf/wg1_cgiar%20development%20challenges%20_3.pdf > (Accessed 05.10).

Matata, P.Z., Gama B.M, Mbwaga, A. Mpanda, M., Byamungu, D.A., 2011. Effect of Sesbania sesban fallows on Striga infestation and maize yield in Tabora Region of Western Tanzania. J. Soil Sci. Environ. Manage. 2: 311-317.

National Bureau of Statistics (2007a). National Sample Census of Agriculture 2002/2003, Vol. Va, Regional Report: Dodoma Region. United Republic of Tanzania.

National Bureau of Statistics (2007b). National Sample Census of Agriculture 2002/2003, Vol. Vu, Regional Report: Manyara Region. United Republic of Tanzania.

Pretty, J., Toulmin, C., Williams, S., 2011. Sustainable Intensification in African Agriculture. International Journal of Agricultural Sustainability 9 (1): 5-24.

Snapp, S. S., Blackie, M.J., Gilbert, R.A., Bezner-Kerr, R., Kanyama-Phiri, G.Y., 2010. Biodiversity can support a greener revolution in Africa. PNAS 107: 20840-20845

Shemdoe, R.S., Kikula I.S., Van Damme, P., 2009. Increasing Crop Yield in Water Scarce Environments Using Locally Available Materials: An Experience from Semi-arid Areas in Mpwapwa District, Central Tanzania. Agricultural Water Management, 96: 963-968

Task Force on INRM, 2000. Integrated Natural Resources Management Research in the CGIAR: A Brief Report on the INRM Workshop Held in Penang, Malaysia 21-25 August 2000.

U. S. Government, 2010. Tanzania FY2010 Implementation Plan. < http://www.feedthefuture.gov/sites/default/files/country/strategies/files/FTF_2010_Implementation_Plan_Tanzania.pdf> (Accessed 10.11).

U. S. Government, 2011. Feed the future: Global food security research strategy. <http://www.feedthegov.gov> (Accessed 11.11).

Vanlauwe, B., Bationo, A.,Chianu, J., Giller,K.E., Merckx, R., Mokwunye, U., Ohiokpehai,O., Pypers, P., Tabo, R., Shepherd, K., Smaling, E., Woomer, P.L., Sanginga, N., 2011. Integrated soil fertility management: Operational definition and consequences for implementation and dissemination. Outlook on Agriculture, 39, 17-24

Wild, C.P., Turner, P.C., 2002. The toxicology of aflatoxins as a basis for public health decisions. Mutagenesis 17(6): 471-481.