TROPICAL AGRICULTURE PLATFORM (TAP)

ASSESSMENT OF CURRENT CAPACITIES AND NEEDS FOR INSTITUTIONAL AND INDIVIDUAL CAPACITY DEVELOPMENT IN AGRICULTURAL INNOVATION SYSTEMS

REGIONAL SYNTHESIS REPORT FOR AFRICA[1]

BY

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EXECUTIVE SUMMARY

The enormity of challenges to Africa's agriculture posed by climate change, environmental degradation, dwindling water reserves, changing demographics, rapid urbanization, and globalizing markets defy conventional approaches to solutions. Yet agriculture is the backbone of Africa's economies and the driving force for socio-economic development. There is thus a compelling need to transform Africa's agriculture as embodied in the aspirations of the Comprehensive African Agriculture Development Programme (CAADP). To achieve broad-based improvements in agricultural productivity, competitiveness and markets there must be functional agricultural innovation systems (AIS) to spawn innovations. The AIS perspective recognizes complexity inherent in the agricultural landscape and that the desired changes in the sector are necessarily emergent, the outcome of dynamic interactions among the network of actors. Recognizing patterns of interaction and underlying structures that shape emergent patterns of system behaviour is a precondition to strengthening the AIS.

The Tropical Agriculture Platform (TAP) is a multi-lateral, multi-sectoral, and dynamic facilitation mechanism conceived at the instance of G8 countries. The TAP seeks to add value to capacity development for agricultural innovation initiatives in tropical countries by fostering collective action, strengthening interactions, and avoiding duplication. As a first transaction of the Platform, regional needs assessments were commissioned in Africa, Asia and Central America to delineate key thrusts for TAP interventions. FARA conducted the assessments in Africa.

Fifteen least developed countries in Africa, five in each sub-region, were chosen for the needs assessments as follows: Comoros, Ethiopia, South Sudan, Rwanda and Tanzania (ASARECA); Angola, Lesotho, Malawi, Mozambique, Zambia (CCARDESA); Benin, Burkina Faso, Gambia, Liberia, and Niger (CORAF/ECARD). The assessment methodology consisted of review of literature material on various aspects of agricultural innovations, stocktaking of current capacity development initiatives, and key informant surveys using a structured questionnaire.

Information from the literature review and survey findings both indicate that the linear mode of research-technology transfer-adoption persists in majority of the target countries. The AIS concept is still largely just a concept, with limited practical application in the national agricultural innovation strategies. Still, the AIS framework needs to be more clearly embedded in the national and regional agricultural strategies and programming. The national agricultural research institutes and public universities are still the predominant contributors to innovations in terms of budget allocation, research output and sheer capacity. Non-state research contribution is only significant in sporadic cases like in Zambia.

All the reviewed countries had an impressive number of universities and other tertiary agricultural education institutes that can potentially contribute more significantly to agricultural innovations through research, involvement in policy dialogues and capacity development. In addition to government ministries and their departments, extension provision in the reviewed countries has increasingly embraced pluralism with significant contribution from NGOs, CSOs, and farmer organizations. Stakeholder responses indicated that universities and research institutes do not engage farmers to a sufficient degree in their innovation efforts.

Various extension approaches and extension financing models have been applied with varying degrees of success in different settings across the continent and there are specific success stories that warrant out-scaling to other regions. These include demand-led models like 'fee-for-service' in eastern Africa and the MAFF in Francophone countries. However, almost all the 15 countries do not have specific policies for agricultural extension and advisory services. Moreover, none of the countries reviewed had exploited the enormous opportunities offered by ICT for extension. This is a clear case for convergence of agricultural, information and communication ministries to broker innovations in e-extension. Coupled to this would be the elaboration of comprehensive national ICT polices; in fact, stakeholder survey responses in all the three sub-regions ASARECA, CCARDESA and CORAF/WECARD indicated that ICT-based innovations would be the best way to tackle socio-economic problems.

The stakeholder survey results revealed that a number of issues affect private sector participation in innovations including distrust inherent in public-private-partnerships for R&D, difficulties to access technologies without IPRs, and lack of investment capital. Some respondents called for protocols that would incentivize private investment in the various subsectors. The survey respondents suggested development of memoranda of understanding (MoUs) to safeguard the intellectual property of researchers who collaborate with the private sector. The provision of essential public infrastructure (roads, electricity, telecommunications, healthcare, and education services) in rural areas would help in reducing the cost of doing agribusiness and thereby encourage private sector players

Both the literature and stakeholder surveys indicated practical and successful models of agricultural financing orchestrated by continental platforms, NGOs, and donor agencies in some countries. The innovative gist in many of the models is risk reduction using various instruments like credit guarantee schemes and index insurance. Such models need to be evaluated and, if appropriate, adopted elsewhere. Further, the success of agricultural innovation systems depends on the power dynamics amongst actors. Public research agencies in majority of the TAP target countries apparently have more power based on the amount of budgetary allocation, research output, and role in setting research priorities. Along value chains, power disparities amongst actors are often evident, influencing prices and profits. Mechanisms to even out power disparities at various scales would be needed.

Several innovative partnerships and platforms exist across Africa to address various issues ranging from research collaboration, mobilizing investments in agriculture, provision of inputs, technology development and adoption, research coordination, developing common standards and codes of practice, transforming tertiary agricultural education, and developing agribusinesses and agribusiness capacity, and for matching the supply and demand in capacities for agricultural innovation. The TAP will benefit from some of these; in fact, the Agricultural Innovation MKTPlace, a triangular collaboration involving Brazil, FARA and Latin America would serve as a good design template for the TAP.

Stakeholders in the three sub-regions provided their views on various priorities for innovations to address specific challenges. On environmental challenges, the respondents prioritized innovations in soil and water management and climate change adaptation. On economic and social challenges, improving smallholder livelihoods, poverty reduction through entrepreneurship and women's participation were given top priority. All the three regions indicated that reform of public extension system would also address, albeit to a lesser degree, economic problems Respondents in all regions preferred provision of government incentives such as tax credits, matching grants, and joint-cooperation platforms to foster PPPs in innovations.

Lastly, from the gaps identified in both the literature and stakeholder surveys, generic and specific recommendations were made for the three TAP components.

Under "Policy Dialogue Space", the issues could be:

- Policy reforms both at national and organizational level to re-position agricultural education institutes so that they can effectively play their roles of producing the required human capital to move Africa's agriculture, undertake innovative research, and develop the capacity of other national agricultural innovation actors
- Facilitating convergence of agricultural, information and communication ministries to broker innovations in e-extension by policy alignments
- Inclusive policy dialogues to repackage smallholder agriculture as a business and thereby unlock potential innovations by private sector players
- Appropriate legal and financial policies to encourage business mentoring, proliferation of SMEs and financing innovations
- Guidelines for representative self-organization by smallholders (formation of farmer groups) to strengthen their participation in agricultural innovation systems

- Changes in university and research organizational operational and governance policies to shed off the 'ivory tower' label and be more open to farmer needs
- Policy dialogues - to address market constraints, input access, extension provision, governance issues, ICT, regulatory framework for micro-finance and IPR issues, incoherence of policy frameworks addressing similar issues, coordination problems due to public actors with same functions being controlled by different line ministries, knowledge flows, inclusive stakeholder engagements in policy formulation and programs, property and land regulations, gender, inheritance laws, innovation agenda setting and prioritization

Under the "Marketplace", examples of capacity development issues are:

1. Individual/human capacity development (at country and regional level; this would be capacity offers on the demand side)
    a. Partnership building and collaborations for enhance capacity to facilitate multi-stakeholder processes – farmers, researchers, extensionists, university staff
    b. Group dynamical skills to help in engaging other stakeholders and value chain actors - farmers, researchers, extensionists, university staff
    c. Coordination skills – programme coordination staff in government ministries; FBO leaders; researchers and university staff
    d. M&E skills – programme coordination staff, researchers and university staff
    e. Strategic thinking – FBO leaders, public policy makers, university staff, researchers

2. Organizational capacity development (these would be offers on the demand side)
    a. Infrastructural endowment of innovation actors – research institutes, universities (this could be at national or supra-national scales)
    b. Rural access infrastructure – roads, ICT and mobile access
    c. Business incubation facilities – to stimulate agribusiness ventures by young people
    d. Curricula and pedagogic reforms at universities in TAP countries
    e. Customizing strategies of actor organizations to respond to national development needs

Under the "TAPipedia", the issues could involve:

a. Comprehensive assessment of extension and agricultural finance models in the region to outline successful approaches for adoption elsewhere
b. Exhaustive inventory of capacity offers or demands currently active in the African countries
c. Exhaustive inventory of agencies providing capacity development funding or technical assistance
d. Inventory of success stories on innovation in Africa and beyond to positive contagion elsewhere (this would need to be done and submitted to the TAPipedia repository)
e. Inventory of all key organizational actors in each of the TAP countries and the major areas of their innovation activities (this would need to be done further and the submitted to the TAPipedia repository)

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LIST OF ABBREVIATIONS/ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
AFD	French Development Agency
AGORA	Access to Global Online Research in Agriculture
AGRA	Alliance for Green Revolution in Africa
AKSCG	Association of Kilimanjaro Speciality Coffee Growers (Tanzania)
ANAFE	The African Network for Agriculture, Agroforestry and Natural Resources Education
APARI	Afar Pastoral Agro-Pastoral Research Institute (Ethiopia)
ARARI	Amhara Agricultural Research Institute (Ethiopia)
ARF	Agricultural Research Fund (Ethiopia)
ASARECA	Association for the Strengthening Agricultural Research in Eastern and Central Africa
ASDP	Agricultural Sector Development Programme (Tanzania)
ASDS	Agriculture Sector Development Strategy
ASIP	Agriculture Sector Investment Plan (Rwanda)
ASLMS	Agricultural Sector Lead Ministries
ASSMAG	Association for Smallholder Seed Multiplication (Malawi)
ASWAp	Agriculture Sector Wide Approach
ATA	Agricultural Transformation Agency (Ethiopia)
ATI	Agricultural Transformation Initiative (Tanzania)
ATVET	Agricultural Technical and Vocational Education and Training
AU	African Union
AUC/NEPAD	African Union Commission/ New Partnership for African Development
BAGC	Beira Agricultural Growth Corridor (Mozambique)
BCA	Bunda College of Agriculture/University of Malawi
BECA	Biosciences Eastern and Central Africa
BMGF	Bill and Melinda Gates Foundation
BPR	Business Process Restructuring
BMZ	The Federal Ministry for Economic Cooperation and Development, Germany
CAADP	Comprehensive African Agriculture Development Programme
CAAZ	Conservation Agriculture Association of Zambia
CCARDESA	Council for the Coordination of Agricultural Research and Development in Southern Africa
CDT	Cotton Development Trust (Zambia and Malawi)
CEPAGRI	Agricultural Promotion Centre
CFU	Conservation Farming Unit (Zambia)
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIDA	Canadian International Development Agency
CIMMYT	International Maize and Wheat Improvement Centre
CIP	International Potato Centre
CIRAD	*Centre de Coopération Internationale en Recherche Agronomique pour le Développement* (French Agricultural Research Centre for International Development)
CITT	Centre for Innovation and Technology Transfer (Rwanda)
CMB	Livestock Multiplication Centre (Niger)
CNRA	National Council for Agricultural Research (Niger)
CNSF	National Forest Seed Center (Burkina Faso)
COFAM	Cotton Farmers Association of Malawi
COMESA	Common Market for Eastern and Southern Africa
CORAF/WECARD	*Conseil ouest et centre Africain pour la Recherche et le Dévelopement Agricole* /West and Central African Council for Agricultural Research and Development
COSTECH	Commission for Science and Technology (Tanzania)
CPA	Comprehensive Peace Agreement (South Sudan)
CRS	Catholic Relief Services
CSIR	Council for Scientific and Industrial Research (Rwanda)
CVRI	Central Veterinary Research Institute (Zambia)
DAES	Department of Agriculture and Extension Services (Malawi)
Danida	Danish International Development Agency
DARN	Directorate of Agriculture and National Resources (Mozambique)
DARS	Department of Agricultural Research (Malawi)

DCA	Directorate of Animal Science (Mozambique)
DFDTT	Directorate of Training, Documentation and Technology Transfer (Mozambique)
DFID	Department for International Development (United Kingdom)
DONATA	Dissemination of New Agricultural Technologies for Africa
DPs	Development Partners
DPAF	Directorate of Planning, Administration and Finance (Mozambique)
DRC	Democratic Republic of Congo
DRD	Department of Research and Development (Tanzania)
DRTE	Department of Research, Training and Extension (Tanzania)
EAAPP	Eastern Africa Agricultural Productivity Programme
EAC	East African Community
ECOWAS	Economic Commission of West African States
EDPRS	Economic Development and Poverty Reduction Strategy (Rwanda)
EIAR	Ethiopian Institute of Agricultural Research
ENSAN	National Food and Nutritional Security Strategy (Angola)
ESE	Ethiopian Seed Enterprise
EU	European Union
FAAP	Framework for Africa's Agricultural Productivity
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FFS	Fee for Service
FISP	Farm Input Support Programme (Malawi)
FOs	Farmer Organizations
FRGs	Farmer Research Groups
FTE	Full Time Equivalent
FUPRO	Federation of Producers' Unions (Benin)
GARI	Gambella Agricultural Research Institute (Ethiopia) Golden Valley
GART	Agricultural Research Trust (Zambia)
GDP	Gross Domestic Product
GFAR	Global Forum on Agricultural Research
GLA	Grain Legumes Association (Malawi)
GNAIP	Gambia National Agricultural Investment Programme
GNI	Gross National Income
GTAZ	Grain Traders Association of Zambia
IAMD	African Institute for Application of Development Methods (Benin)
IAPRI	Indaba Agricultural Policy Research Institute (Zambia)
ICLARM	World Fish Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDR	Institute for Rural Development (Burkina Faso)
IDRC	International Development Research Centre (Canada)
IFAD	International Fund for Agricultural Development
IIAM	The Agricultural Research Institute of Mozambique
IIP	Fisheries Research Institute (Mozambique)
IP	Innovation Platform
IITA	International Institute for Tropical Agriculture
INEA	Istituto Nazionale di Economia Agraria, Italy
INERA	The Environment and Agricultural Research Institute (Burkina Faso)
INRAB	Benin National Institute of Agricultural Research
INRAN	Niger National Institute of Agricultural Research
INTSORMIL-CRSP	International Sorghum/Millet Collaborative Research Support Programme
IPAR	Institute of Policy Analysis and Research (Rwanda)
IPR	Intellectual Property Rights
IPTA	Innovation Platforms for Technology Adoption
IRRI	International Rice Research Institute
IRRI	International Rice Research Institute
IRSAT	Applied Science and Technology Research Institute (Burkina Faso)
IRST	Institute for Scientific Research and Technology (Rwanda)
ISAR	*Institut des sciences agronomique du* Rwanda

JICA	Japan International Cooperation Agency
KARI	Kenya Agricultural Research Institute
KIST	Kigali Institute of Science, Technology and Management (Rwanda)
LASIP	Liberia Agriculture Sector Investment and Development Programme
LDCs	Least Developed Countries
LGAs	Local Government Authorities
MAF	Ministry of Agriculture and Forestry (South Sudan)
MAFCRD	Ministry of Agriculture, Forestry, Cooperatives and Rural Development (South Sudan)
MAFF	Management Advice for Family Farms
MAFS	Ministry of Agriculture and Food Security (Tanzania)
MARF	Ministry of Animal Resources and Fisheries (South Sudan)
MCM	Ministry of Cooperatives and Marketing (Tanzania)
MINADER	Ministry of Agriculture (Angola)
MINAGRI	Ministry of Agriculture and Animal Resources (Rwanda)
NAEB	National Agricultural Export Development Board (Rwanda)
NAFSIP	National Agriculture and Food Security Investment Plans (of CAADP)
NAIS	National Agricultural Innovation System
NALEP	National Agriculture and Livestock Extension Policy
NAMA	Nationally Appropriate Mitigation Action
NAPs	National Agricultural sector investment Programmes
NARF	National Agricultural Research Fund (Tanzania)
NARIs	National Agricultural Research Institutes
NARS	National Agricultural Research Systems
NASFAM	National Association of Smallholder Farmers (Malawi)
NEPAD	New Partnership for Africa's Development
NGO	Non-Government Organization
NIC	National Innovation Coalition (Malawi)
NPA	Norwegian Peoples Agency
NPCA	NEPAD Planning and Coordinating Agency
NSFS	Networking Support Functions
NSTIP	National Science, Technology and Innovation Policy (Rwanda)
NUR	National University of Rwanda
NVRC	National Variety Release Committee (Ethiopia)
OARI	Oromiya Agricultural Research Institute (Ethiopia)
OBEPAB	Organization for the Promotion of Organic Agriculture in Benin
OPV	Open Pollinated Varieties
PAFFO	Pan African Farmers Forum
PanAAC	Pan African Agribusiness and Agro-industry Consortium
PANGOC	Pan African Non-governmental Organisation Consortium
PASAN	National Food and Nutritional Security Action Plan (Angola)
PEDSA	Plan for Development of Agriculture Sector (Mozambique)
PIAD	Partnership for Agricultural Development
PIF	Policy and Investment Framework (Ethiopia)
PO-RALG	President's Office-Regional Administration and Local Government (Tanzania)
PPPs	Public-Private Partnerships
PROLINNOVA	Promoting Local Innovation
PSTA	Strategic Plan for the Transformation of Agriculture (Rwanda)
R&D	Research and Development
RAB	Rwanda Agricultural Board
RADA	Rwanda Agriculture Development Authority
RARIs	Regional Agricultural Research Institutes
RBS	Rwanda Bureau of Standards
RDB	Rwanda Development Bank
REACs	Research Extension Advisory Councils (Ethiopia)
REDD	Reducing Emissions from Deforestation and Forest Degradation
REMA	Rwanda Environment Management Agency
RIU	Research-Into-Use
RKN	Rural Knowledge Network (Kenya, Uganda, Tanzania)
RSEs	Regional Seed Enterprises

SABIMA	Strengthening Capacity for Safe Biotechnology Management in sub-Saharan Africa
SADC	Southern African Development Community
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SARI	South Agricultural Research Institute (Ethiopia)
SCARDA	Strengthening Capacity for Agricultural Research and Development in Africa
SCFCU	*Sidam* Coffee Farmers Cooperative Union (Ethiopia)
SDC	Swiss Development Cooperation
SIDA	Swedish International Development Agency
SIMLESA	Sustainable Intensification of Maize-Legume cropping Systems for food security in Eastern and Southern Africa
SNV	Netherlands Organization for Development
SOFITEX	Burkinabe Company for Textiles Fibres
SOPARI	Somali Pastoral Agro-Pastoral Research Institute (Ethiopia)
SPAAR	Special Programme on Africa's Agricultural Research
SSA	Sub-Saharan Africa
SSA-CP	Sub-Saharan Africa Challenge Programme
STAM	Seed Trade Association of Malawi
TaCRI	Tanzania Coffee Research Institute
TAE	Technical Agricultural Education institutes
TAFORI	Tanzania Forestry Research Institute
TAP	Tropical Agriculture Platform
TARI	Tigray Agricultural Research Institute (Ethiopia)
TCI	Investment Centre Division (FAO)
TFP	Total Factor Productivity
TORITA	Tobacco Research Institute of Tanzania
TRIT	Tea Research Institute of Tanzania
TVET	Technical and Vocational Education and Training
UAM	Abdou Moumouni University (Niger)
UEM	Eduardo Mondlane University (Mozambique)
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNMIL	United Nations Military Intervention in Liberia
USAID	United States Agency for International Development
WAAPP	West African Agricultural Productivity Programme
YPARD	Young Professionals Platform for Agricultural Research for Development
ZAECs	Zonal Agricultural Executive Committees (Tanzania)
ZARDIs	Zonal Agricultural Research and Development Institutes (Tanzania)
ZARFMTs	Zonal Agricultural Research Fund Management Teams (Tanzania)
ZARI	Zambia Agriculture Research Institute
ZCGA	Zambian Cotton Ginners Association
ZEGA	Zambia Export Growers Association
ZNFU	Zambia National Farmers Union
ZSTA	Zambian Seed Traders Association
ZTCs	Zonal Technical Committees (Tanzania)

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1. INTRODUCTION

1.1 Background of TAP

The inspiration to develop a platform for capacity development in tropical agriculture in developing countries received impetus from the declaration of the G20 ministerial meeting in Paris and subsequent resolution of the G20 Conference on Agricultural Research for Development, held in September 2011 in Montpellier, France. Later, in December 2011, FAO convened a stakeholder consultative meeting in Rome, Italy, that enabled the articulation of value proposition, an initial action plan, and critical elements of the governance structure, potential resources and costs for the budding "Tropical Agriculture Platform (TAP)". The Rome meeting also constituted a team of representatives from stakeholder organizations (INIFAP, EMBRAPA, GFAR, INEA, FARA, IAO and FAO) to develop the detailed proposal for the Platform. Subsequently, several high-level stakeholder forums endorsed the TAP proposal.

The TAP is a multi-lateral and dynamic facilitation mechanism to address coordination failures in capacity development and innovation policies and initiatives in African agriculture. TAP will capitalize on and add value to on-going initiatives by fostering capacity development for innovation in tropical agriculture. It will also strengthen stakeholder interactions for more harmonized action and greater mutual accountability, while avoiding duplication. The TAP proposes a multi-pronged approach encompassing four main thrusts thus:

1. Regional needs assessment reflecting current priorities, capacities and needs in agricultural innovation systems, formulation of a strategic action plan, and development of a framework for coordinated actions;
2. "Policy Dialogue Space" for convening multi-stakeholder interactions which enhance clarity and coherence of national policies for capacity development in tropical agricultural innovation systems;
3. "Marketplace" for brokering effective capacity development approaches and partnerships in tropical agriculture which aggregate and promote existing demands and offers, and facilitate up-scaling; and
4. "TAPipedia" to create an information systems that enhances knowledge flows in support of capacity development of tropical innovation systems, capturing success stories, socioeconomic impacts, lessons learned, and innovation outputs.

The intended users of the Platform include policymakers, development agencies, institutions in agricultural innovation (research, extension, education etc), private sector and civil society engaged in innovation processes to support small producers. TAP is facilitated by FAO in its role as global convenor and knowledge broker. The primary partners at national, regional and international levels represent constituencies involved in tropical agricultural innovation, which will share their knowledge and experiences, and learn from each other about sound capacity development policy and practice.

The Platform will foster greater coherence of capacity development interventions that acknowledge national leadership and ownership and are aligned with national plans and demands, based on stronger partnerships and shared visions. The wide adoption of the aid effectiveness agenda across the international community will provide the context for this coherence. The Platform will improve the effectiveness and efficiency of capacity development programmes to facilitate the emergence of innovation systems in tropical agriculture, which contribute to food security and environmental sustainability. Sustainable development solutions at scale will be developed with lower transaction costs, based on integrated approaches across the three capacity dimensions of enabling environment, organizations and individuals. The ultimate "impact groups" who will benefit from the Platform will be small and medium-scale farmers, as well as small and medium enterprises in the agribusiness sector.

1.2 FARA as the Implementing Agency for TAP in Africa

In Africa, economic development, food security, and poverty reduction have direct links to agricultural development. Incidentally, Africa has perhaps one of the most clearly defined organizational architecture for continental agricultural engagement starting from the sub-national organizations (i.e. universities, research institutes, extension agencies, farmer organizations, and so on) to the supra-national organizations (ASARECA, CCARDESA, CORAF/WECARD, and NASRO), and, finally, the apex continental organization, FARA, that links up with the Global Forum on Agricultural Research (GFAR).

Africa also stands out as the only continent with a unique all-encompassing policy framework for agricultural development. For about a decade, African countries have increasingly embraced the AUC/NEPAD's Comprehensive Africa Agriculture Development Program (CAADP) that seeks to attain annual agricultural production of 6% and ensure at least 10% of national budget allocation to agricultural development in all African countries. To achieve the 6% annual production target, CAADP specifies four strategic pillars for collective action:

- Pillar I deals with extending the area under sustainable land management and reliable water control systems;
- Pillar II is concerned with improving rural infrastructure and trade-related capacities for improved market access;
- Pillar III focuses on increasing food supply and reducing hunger; and
- Pillar IV is on agricultural research, technology dissemination and adoption. Each of these pillars identifies enabling policies, institutional reform and capacity building as necessary preconditions for agricultural growth.

For nearly a decade, FARA has led the implementation of CAADP Pillar IV by a mandate from the AUC/NEPAD. The mission of FARA is to create broad-based improvements in agricultural productivity, competitiveness and markets by supporting African organizations and networks in strengthening the national agricultural innovation systems. FARA was selected as Recipient Organization by FAO to facilitate TAP implementation in Africa. This is mainly due to its position as the umbrella organization bringing together and forming coalitions of major regional stakeholders in agricultural research and development. Apart from its regional mandate and stakeholder base, the suitability of FARA as a Recipient Organization was further buttressed by its engagement in the design of the TAP proposal *ab initio*, established administrative and operational structure, proven fiduciary probity, and pertinence of proposed TAP activities to past and on-going FARA actions.

1.3 Objectives and scope of the assignment

As provided in the Letter of Agreement with FAO, FARA was mandated to execute the following tasks in selected African countries contributing to the first TAP programmatic thrust:

1. Conduct desk studies of current priorities, capacities and needs of stakeholders in agricultural innovation in terms of (a) existing institutional and individual capacities, and availability of resources (e.g. infrastructure, levels of investment, plans for expansion and/or contraction of activities, skills, learning materials, sharing tools), and (b) development priorities and needs;
2. Identification and stock-taking of existing initiatives in Africa in capacity development in tropical agriculture innovation involving G20 members, as well as regional and international institutions to (a) map stakeholders and partnerships, (b) document geographic and subject areas of interest, and nature of activities, and (c) document effective linkages with other stakeholders, including South-South and North-South collaboration;
3. Based on the capacity and needs assessment, identify gaps and prepare a regional synthesis report on capacity development for strengthening agricultural innovation systems in least developed countries (LDCs) in Africa, identify national, regional and international interventions to strengthen capacities and formulate draft policy recommendations to address capacity gaps.

1.4 Rationale for Country Selection for the TAP Assessment in Africa

According to the UN[2], least developed countries (LDCs) are those countries with low gross national income (GNI), weak human assets, and high degree of economic vulnerability invariably characterized by instability of agricultural production. Currently, about 50 countries worldwide are classified as LDCs and nearly 70% of which are in tropical Africa. A total of 15 LDCs, five from each of the three FARA-associated sub-continental organizations in sub-Sahara Africa, were randomly selected for the TAP assessments thus: ASARECA (Comoros, Ethiopia, Tanzania, Rwanda, and South Sudan); CCARDESA (Angola, Lesotho, Malawi, Mozambique, and Zambia); CORAF/WECARD (Benin, Burkina Faso, The Gambia, Niger, and Liberia). Politically, Tanzania belongs to CCARDESA sub-region, but was grouped with the ASARECA countries due to geographical and agro-ecological proximity.

[2] http://unctad.org/en/Pages/ALDC/Least%20Developed%20Countries/UN-list-of-Least-Developed-Countries.aspx

2. SUMMARY OF METHODOLOGY AND APPROACH

As indicated above, the TAP assessment exercise was threefold. The implementing partners jointly developed the methodology employed to execute Part 1 of the assignment based on the following tasks:

- Task 1 - review and mapping of main stakeholders' involvement in the national agricultural innovation system;
- Task 2 - review of the institutional and political economy context;
- Task 3 - review of capacity levels and needs, and
- Task 4 – questionnaire surveys administered to key contact persons in stakeholder organizations of target countries to gauge the functionality of the national agricultural innovation systems. The survey questionnaire had to be translated into French and Portuguese for the benefit of the Francophone and Lusophone African countries, respectively. Questionnaires were mailed to key contacts in the following organizations of target countries: a university, a national research institute, a government or policy-making body, an agribusiness concern, a national extension agency, an agro-focused NGO or civil society, and a farmer-based organization.

Appendix 1 gives a detailed summary of the survey responses. Further, Fig. 1 shows the distribution of responses by the various stakeholder groups in each of the three sub-regions. In ASARECA, majority of responses were from private sector agribusinesses, which was quite in contrast to CCARDESA and CORAF/WECARD where there were no responses from agribusiness stakeholders. Perhaps this points to the relatively more advanced agribusiness subsector in ASARECA countries as compared to the other regions. Public research agencies and universities constituted the majority of stakeholder responses in CCARDESA and CORAF/WECARD. It is instructive to note that there was no responses from stakeholders in extension in all the sub-regions, although the survey questionnaire was flagged in the e-mail network for AFAAS. In many countries, the extension docket is within the ministry of agriculture; hence, some of the extension concerns might have captured in the responses from the ministries.

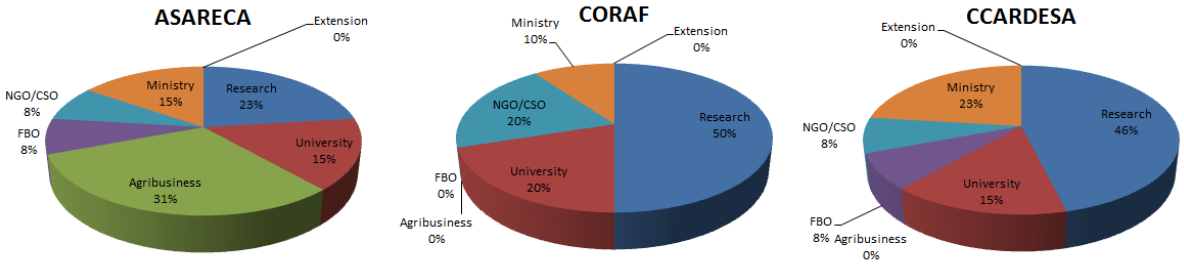

Figure 1: Stakeholder share of responses per sub-region

Part 2 of the TAP assessment entailed stocktaking of existing capacity development initiatives in tropical agricultural innovation and identification of champions in agricultural innovation in the 15 target countries. Due to limited timeframe, FARA engaged a consultant to execute Part 1 and three other consultants each to focus on the set of five countries in ASARECA, CCARDESA and CORAF/WECARD with respect to Part 2. Sources of data and records for review by the consultants included the material repository by FAO on TAP Dgroups, CAADP implementation updates on the NEPAD websites, FARA reports and publications, as well as other online sources (especially G20 websites) of published works relevant to the target countries. Each of the four consultants produced an independent report based on the specified tasks from which FARA compiled the regional synthesis report.

3. REGIONAL AND COUNTRY CONTEXTS

3.1 Development Indicators

Appendix 2 shows the variation of some key development indicators in the three sub-Sahara African countries and sub-regions. The data for South Sudan was largely unavailable. The ASARECA region had highest average population (34.3 million people) with an 'anomalous' standard deviation of 37.2 million, depicting the two demographic extremes of Ethiopia (82.8 million) and Comoros (0.7 million). The average population of the CORAF/WECARD countries was the least at about 9 million. Perhaps to make up for this shortfall, the annual population growth rate is highest in the CORAF/WECARD region at 3.5% per annum, while CCARDESA countries had the least average growth rate at 2.2% per annum. The growth rate for the entire Sub-Saharan Africa (SSA) region is 2.5%, the highest in the world. This high population growth rates and other demographic components such as urbanization and the youthful bulge will drive future innovations in Africa's agriculture.

Moreover, the TAP countries in the CCARDESA sub-region had the highest average land area of about 580,000 km^2, with a standard deviation of about 512,000 km^2. ASARECA and CORAF/WECARD sub-regions had average land areas of 478,000 and 410,000 km^2, respectively.

The average GDP per capita in 2009 was highest for CCARDESA countries at about USD$545, principally contributed by earnings from extractive industries in Angola, Mozambique and Zambia. This was however lower than the SSA average of US$618. Indeed, Angola from the CCARDESA had the highest GDP per capita of USD$1,313 (twice the average GDP per capita for the entire SSA region), but Malawi from the same sub-region, relatively less endowed with natural mineral resources, had a GDP per capita of only USD$168. The rest of the countries had GDP per capita GDP below USD$1,000, with Liberia having the least at USD$148. The average annual GDP growth rate was highest in CCARDESA (3.7%) and lowest in CORAF/WECARD (0.8%). However, both CCARDESA and CORAF/WECARD have relatively higher between-country variations in GDP growth per year, 3% and 1%, respectively. Two countries, Comoros and Liberia, exhibited negative GDP growth in the last decade, while Niger's economy was virtually stagnant over the same period. With the exception of South Sudan[3], the rest of the ASARECA countries considered had GDP growth rates of 3.9% and above, compared to the less than 2% growth rate for all CORAF/WECARD countries.

On average, the agriculture sector accounts for 27% of the GDP in SSA. Within the ASARECA countries, the average share of agricultural value added in total GDP was about 42% in 2009 compared to about 21% in CCARDESA. Agricultural contribution to GDP data was generally unavailable for CORAF/WECARD countries. At the individual country level, agricultural value added in GDP was highest in Ethiopia (50.7%) and lowest in Lesotho (8.4%). During the period 1996 – 2011, the general GDP growth in SSA countries has been directly attributed to the corresponding agricultural GDP growth (Atwood et al, 2013[4]). However, growth in aggregate agricultural GDP has not translated to reduction in poverty, especially in rural areas.

Inequality in income or wealth distribution in Africa is positively associated with GDP per capita. CCARDESA sub-region with highest GDP per capita is the most unequal as indicated by its *Gini* index of 50% compared to about 46% and 40% in ASARECA and CORAF/WECARD, respectively. Moreover, Angola – with its vast mineral resources - had the highest *Gini* index of 59%, showing high inequality of wealth distribution. On the contrary, income is fairly shared in those countries with lower GDP per capita; for instance in Ethiopia, Niger and Tanzania where the *Gini* indices are 29.8%, 34.0% and 37.6%, respectively.

[3] South Sudan is the newest country in Africa. It was created through division of Sudan after decades of civil war. Its formation began with the installation of a Comprehensive Peace Agreement (CPA) and semi-autonomous government in 2005. South Sudan has a high agricultural potential with soils and climatic conditions that can support a variety of food, cash crops and animal production. However, only less than 2% of total land area is cultivated (<1.3 million hectares out of 640,000 km^2). About 90% of the population depend on agriculture, 80-90% generate less than USD$1 per day. Majority rely on emergency relief food from external sources (Government of South Sudan, 2011). The development indicators for South Sudan are largely still undocumented.

[4] Atwood, D., Jayne, T., and Wolgin, J. (2013). What will it take to transform African agriculture 2013 – 2030? MPEP Seminar Series, Knowledge-Driven Microenterprise Development Project (KDMD), USAID, USA.

Generally, three quarters of the population in all countries reviewed lived on less than USD$2 per day (World Bank, 2011). The average proportion of poor people was highest in ASARECA (84.2%) and lowest in CCARDESA (73.9%). Variations in poverty index were higher in CORAF/WECARD countries with Liberia displaying the highest poverty index of 95%, while the Gambia had 57%. Malawi in CCARDESA had a poverty index of 91%, while the lowest index for the region was that of Lesotho at 62% (World Bank, 2011). The average Human Development Index (HDI) in SSA is 0.463 and all the countries reviewed have low HDI that range from 0.304 in Niger to 0.508 in Angola. On a regional basis, CCARDESA has an average HDI of 0.5, while both ASARECA and CORAF/WECARD have HDI of 0.4.

A country's level of business environment-friendliness can be measured by how it scores on ten key business indicators: ease of starting a business, dealing with construction permits, getting electricity, registering property, accessing credit, protecting investors, process of paying taxes, ease of cross border trade, enforcing of contracts and mechanisms to resolve insolvency. Among the 186 countries ranked by the World Bank (2013), only Rwanda and Zambia featured in the top 100 with respect to ease of doing business (position 52 and 94, respectively). Niger, Benin and Angola are the least friendly countries to do business in being ranked at 176, 175 and 172, respectively. On a regional basis, the World Bank ranking shows that it is relatively easier to do business in ASARECA (115) than in CCARDESA (143) and CORAF/WECARD (160).

Agriculture supports the livelihoods of many people in the SSA region by providing employment (direct and indirect) to about 60% of the population. The share of agricultural labour in total labour supply is highest in East Africa averaging about 80%. In Benin, agriculture accommodates 60% of the national workforce (Moumouni and Idrissou, 2012). In Burkina Faso and Rwanda, up to 90% of the population is employed in agriculture (IPAR, 2009). Women comprise about 50% of the agricultural labour force in SSA. At the individual country level, women participation in agricultural labour ranges from 33% in the Gambia to 60% in Lesotho and Mozambique. Women employment in high-value agro-industries varies from 35% to 65%, especially in flowers and commercial vegetable production sub-sectors as noted in the Zambian case (FAO, 2011a; Polaski, 2006).

Up to 80% of farms in SSA are smallholder (<2 hectares) and contribute 90% of farm output. However, the share of cultivated arable land is limited as there is high dependence on rain-fed agriculture. For instance, despite Angola having the second largest land area (and with high agricultural potential) among the TAP target countries, only 3% of its arable land is utilized for agriculture. Further, Rwanda, which is the second most densely populated country in SSA after Mauritius, has an average agricultural land holding of 0.76 hectares (Booth and Golooba-Mutebi, 2012). Declining land sizes and increasing population call for concerted efforts (including promotion of agricultural innovations) to raise productivity, link farmers to better markets and address the challenge of high poverty levels in SSA countries.

The average total factor productivity (TFP) in agriculture for the period 1981 – 2001 showed an increase in West Africa (1.47) and CCARDESA (0.45), but decreased in ASARECA (-0.20). At the individual country level, Benin had the highest TFP of 2.96, while Malawi, Rwanda and Tanzania had negative TFP in agriculture (Avila and Evenson, 2005[5]). However, due to emphasis on crop intensification in Rwanda, significant yield increases were recorded in the subsequent years leading to annual agricultural GDP growth rate of 8% in 2009 and 5% in 2010 (Booth and Golooba-Mutebi, 2012). Moreover, policy and technological changes in the last decade (for example, the farm input subsidies in Malawi) are considered to have contributed to substantial improvements in TFP for various countries.

Indeed, Benin, Malawi, Tanzania and Zambia had a sustained agricultural TFP growth path in 1980s and 1990s; each increased its TFP by at least 30% between 1980 and 2008. Angola and Mozambique showed strong TFP growth (or TFP recovery) from 1991, after a prolonged period of decline during protracted civil

[5] Avila, A.F.D. and Evenson, R.E. (2005). Total Factor Productivity Growth in Agriculture: The Role of Technological Capital. Research Report, Chapter 72. Economic Growth Centre, Yale University, New Haven.

wars, but their average TFP remained low over the five decades (1961 – 2008). Overall, the CCARDESA countries had the highest average TFP growth of 0.43% per year from 1961 to 2008, while CORAF/WACARD region had a negative TFP growth (-0.04). Four countries, Angola and Lesotho in CCARDESA and Gambia and Rwanda had negative TFP growth during the period of focus (Fugile and Rada, 2011). This projects a picture of ineffective agricultural innovation systems in the region.

Three of the countries reviewed in ASARECA (Comoros, Rwanda, and South Sudan), Angola and Mozambique in CCARDESA and Liberia in CORAF/WECARD have faced political instability at various times that threatened livelihoods and made it difficult for development initiatives to take root. On the other hand, Ethiopia and Tanzania are thought to have been slow in agricultural development due to the policies they adopted with respect to land use. The land in the two countries belonged to the states and acted as disincentive to private business-oriented development.

3.2 Country Agro-ecologies and Important Challenges to Agricultural Development

Angola: Situated in South Western Africa with geographic coordinates of 12 30 S, 18 30 E, Angola borders the South Atlantic Ocean to the west, Namibia to the south, Zambia to the east and Democratic Republic of the Congo to the North. It has a total area of 1,246,700 km2. Angola's climate is characterised as semi-arid in the south and along the coastal regions up to Luanda. The terrain consists of a narrow coastal plain rising abruptly to vast interior plateau in the hinterlands. The climate condition is conducive for agro-pastoral activities throughout the year. Angola boasts of excellent hydrographical basins represented by seven major rivers and two smaller groups of rivers. Agricultural production and productivity in the country is generally low as only 5.7% of arable land is exploited and that with insignificant use of available technology (FANR, 2011). Moreover, due to decades of protracted post-independence civil war, the country suffered massive de-capitalization, especially the destruction of physical infrastructure and loss of animal traction, technical personnel and other substantial farm machinery. The poor infrastructure and lack of technologies available to farmers corresponds with Angola's rank 172 only in the list on Ease of doing business (Appendix 1).

Benin: Agro-ecological characteristics of Benin have been documented elsewhere by FAO (2013). Benin's latitude ranges from 6°30′N to 12°30′N and its longitude from 1°E to 3°40′E with an area of 112 622 km2. The country has 93.1 % grassland area (making her the country with the highest grassland area in Sub-Saharan Africa) and extensive forest coverage with fertile arable lands. Agricultural development in Benin is plagued by low mechanisation of agriculture coupled with an almost total absence of large farms, lack of market outlets for farm produce at competitive prices, and inappropriate land tenure systems (Aregheore, 2009) that hinder its use a collateral. Other challenges include vulnerability to climate change (Moumouni and Idrissou, 2012), poor rural transport systems, and inadequate post-harvest handling practices. The poor infrastructure and lack of services corresponds with Benin's rank 175 only in the list on ease of doing business (Appendix 1).

Burkina Faso: Burkina Faso is a landlocked country in west Africa around 274,200 square kilometres in size. It is one of the world's poorest nations, with 45 percent of the population living on less than a dollar per day. Most people live in rural areas and survive on subsistence farming on small family plots of land. Maize, sorghum and millet make up 85-90 percent of the staple diet in Burkina Faso, while in rural areas these cereals make up nearly 100 percent of consumption and little is ever marketed. Infertile soils and high variability in annual rainfall leads to frequent droughts in the country. Shorter season cycles due to climate change lead to low yields from traditional seeds and cultivation techniques. Lack of adequate communications and other infrastructure coupled with low literacy rate (FAO and AGORA, 2010).

Comoros: The Comoros archipelago occupies an area of 1,862 km^2, excluding the contested island of Mayotte, and lies between the northern tip of Madagascar and Africa mainland. The population is about 743,000 persons. Over 70 percent of the population lives in the rural areas and depends on agriculture for

livelihoods. The coastal lowlands support the production of vanilla, cloves and perfume essence, while the highlands support the production of cassava, bananas, rain-fed rice, and sweet potatoes, and also raise some livestock. However, domestic agriculture produces only about 50 percent of the required food, and therefore Comoros is a net importer of food. The country recognizes multi-sectoral and multi-thematic interventions as the most prudent way forward (ISFD 2011). For the agricultural sector, extension services and productivity programs are recommended to assist in food security concerns and improved cash crop yield for increased export earnings.

Ethiopia: Ethiopia is located in East Africa, it is a landlocked country bordered by Somalia, Eritrea, Sudan, Djibouti and Kenya with an area of 1,127,127 km^2. It lies between latitudes 3° and 15°N, and longitudes 33° and 48°E. Ethiopia is an ecologically diverse country, ranging from the deserts along the eastern border, the tropical forests in the south to extensive Afromontane in the northern and southwestern parts. Deforestation is a major concern for Ethiopia as studies suggest loss of forest contributes to soil erosion, loss of nutrients in the soil, loss of animal habitats and reduction in biodiversity. Ethiopia's economy is generally dependent on the agricultural sector. The sector accounts for almost 50 percent of the Gross Domestic Product and 90 per cent of the total export revenue, and employs 85 per cent of the country's labour force (Abate, 2006, in Kassa 2009). Agriculture in Ethiopia is characterized by small-scale subsistence farming, using traditional tools and farming practices and is crucially dependent on rainfall. The productivity is low, with an average grain yield of one metric ton per hectare (Byerlee et al 2007, in Kassa 2009). The livestock sub-sector is also important, providing meat, milk, hides and skins for export, and draught power for cultivation and transport (NEPAD, 2011).

The Gambia: The Gambia is a country in West Africa. The Gambia is a very small and narrow country whose borders mirror the meandering Gambia River. It lies between latitudes 13° and 14°N, and longitudes 13° and 17°W. The country is less than 48.2 km wide at its widest point, with a total area of 11,295 km^2. Approximately 1,300 km^2 (11.5%) of the Gambia's area is covered by water. It is the smallest country on the continent of Africa. For decades, the country has suffered food deficits, which has been exacerbated by the recent harsh weather patterns and reduced aid flows. Much of the soil is degraded or unsuitable for farming, with just 20 percent of the Gambia's land considered arable. As a country in the Sahel zone, the Gambia has a long dry season, yet agriculture depends on decreasing amounts of rainfall. Only 6 percent of agricultural land is irrigated, mostly for rice in the Central River region (FA, 2013). The Gambia has a liberal, market-based economy characterised by traditional subsistence agriculture, a historic reliance on groundnuts (peanuts) for export earnings. Agriculture accounts for roughly 30% of gross domestic product (GDP) and employs about 70% of the labour force. Within agriculture, peanut production accounts for 6.9% of GDP, other crops 8.3%, livestock 5.3%, fishing 1.8%, and forestry 0.5%.

Lesotho: Lesotho covers an area of 30,355 km^2 and is completely surrounded by the Republic of South Africa (R.S.A). Over two-thirds of the country is mountains. It is divided into four agro-ecological zones, namely the mountains, foot-hills, lowlands and Orange-River-Valley. All the land in Lesotho is over 1,500 m above sea level. The lowlands 1,500 - 1,800 m in altitude : 15% of the country; The foothills 1,800 - 2,200 m high : 10 - 15% of the area; The mountains 2,200-3,000 m in elevation: over 2/3 of the country; The Orange-River-Valley is the extension of the lowlands into Eastern mountain along the Senqu (Orange) River. There are no farms in Lesotho but rather fields whose average sizes are 3-4 ha. The commercial farmers lease land from these small holders on seasonal/annual or long term basis. The land in Lesotho is the property of the nation in the custody of the king and is allocated free to any adult male. Agricultural challenges in Lesotho include limited access to finance, agricultural inputs, technology, quality extension services, market information; poor market organization and limited capacity to deal with agricultural risks; limited foundation for Research and Development (R&D) with few institutions engaged in scientific research; and most previous policies focused on general agriculture with limited emphasis on development of smallholder farming (Government of Lesotho, 2012).

Liberia: Liberia is situated between latitudes 4-9°N and longitudes 7- 12°W with a total land area of 111 400 km^2. The country has a humid tropical climate with a rainy season extending from April to November. The average annual rainfall varies from 1800 mm in the north to 5000 mm at the coast. The dry season extends

from December to March and the highest air temperature recorded has not exceeded 34°C. The 1985 census recorded a national population of 2.1 million; 80-85 percent of the working population was engaged in agriculture and forestry with over 90 percent of these earning a living from traditional agriculture. Agriculture in Liberia was previously dominated by export crops which included rubber, oil palm, coffee, cocoa and citrus. Although these export crops still account for a substantial portion of Liberia's foreign exchange earnings, an increase in food crop production is now very evident. Food crops grown include rice (both upland and swamp), cassava and other root crops, banana, pulses and vegetables. The most prevalent methods of cropping are "slash and burn" and shifting cultivation. At present, food crops are produced mainly by subsistence farmers.

Malawi: Malawi is a small land-locked country situated between latitude: 13º 30´ south of the Equator and longitude: 34º 00´ east of Greenwich Meridian. It is bounded by Tanzania to the north, Zambia to the west and Mozambique to the east and southern end. Malawi has a vast range of agro-ecological zones offering various challenges and opportunities for agricultural innovation. To the north are the high plateaus reaching to heights of 1,830 - 2,440 m. The lowlands of the Kasungu and Lilongwe plains occupy the central zones with an altitude of about 1,070 m, while the southern parts of the country is characterized by the Shire Highlands with peaks at Zomba Plateau (2,130 m) and Mulanje Mountain (3,000 m), which is the highest mountain in Central Africa. In the southernmost parts of the country is the Lower Shire Valley, only just above sea level. The Malawian economy is mainly based on agriculture with about 87 percent of the population deriving their livelihood directly from agriculture. The sector accounts for 36 percent of national GDP and contributes more than 70 percent of export revenues. Most Malawians are subsistence farmers with women producing 75 percent of the nation's food supply. Challenges to agricultural growth include rain-dependence, limited arable land, deforestation, depleted soils, HIV/AIDS prevalence, primitive tillage practices, and susceptibility to external economic and natural shocks (UNDP, 2008). Malawi is one of the world's poorest countries ranking 171 out of 187 countries on the UNDP's 2011 human development index.

Mozambique: Mozambique lies on the southeast coast of Africa bounded by Swaziland to the south, South Africa to the southwest, Zimbabwe to the west, Zambia and Malawi to the northwest, Tanzania to the north and the Indian Ocean to the east. The country is situated between latitudes 10° and 27°S, and longitudes 30° and 41°E. The population is predominantly rural (about 70%) and most depend of subsistence agriculture, characterized by low productivity and high vulnerability to climatic shocks (UNDAF 2011). As a result, the country is liable to food insecurity and low and unpredictable incomes. The country has vast lands with good agricultural potential (46 percent of the land area suitable for cultivation), but only 14 percent of the land is currently used for agriculture. In preparing strategies to rebuild Mozambique after the long fought civil war that ended in 1992, agricultural research was identified as one of the principal pillars for increasing agricultural productivity. Whereas the Ministry of Science and Technology oversees all research in Mozambique, the Agricultural Research Institute of Mozambique (IIAM - Instituto de Investigação Agrária de Moçambique) is the country's main agricultural R&D agency, accounting for two-thirds of national agricultural research investments and human resource capacity.

Niger: Niger is a landlocked country in Western Africa. It borders Nigeria and Benin to the south, Burkina Faso and Mali to the west, Algeria and Libya to the north and Chad to the east. Niger covers a land area of almost 1,270,000 km^2, making it the largest nation in West Africa, with over 80 percent of its land area covered by the Sahara desert. The economy is largely subsistence with some export agriculture clustered in the more fertile south. Niger remains handicapped by its landlocked position, desert terrain, poor education and poverty of its people, lack of infrastructure, lack of property rights, lack of free markets, poor health care, and environmental degradation. Agriculture is the mainstay of the country's economy, with most families relying on subsistence farming and livestock breeding for their survival. Millet, sorghum and cassava are the main crops. However, perennial episodes of drought, coupled with desertification and locust invasions, cause frequent crop failures. Consequently, the country suffers chronic food insecurity; a situation that has not been helped by the soaring global food and agricultural input prices.

Rwanda: Rwanda, officially the Republic of Rwanda, is a sovereign state in central and east Africa. Located a few degrees south of the Equator, Rwanda is bordered by Uganda, Tanzania, Burundi, and the Democratic

Republic of the Congo. Rwanda has an area of 26 thousand square kilometers, of which 3 percent is water. Rwanda's countryside is covered by grasslands and small farms extending over rolling hills, with areas of rugged mountains that extend southeast from a chain of volcanoes in the northwest. Rwanda agricultural research has undergone a paradigm shift over the years, from traditional research extension linear processes, managed by ISAR, until 2011, to Integrated Agricultural Research for Development (IAR4D) based on innovation platforms (IP) approach, managed by the Rwanda Agricultural Board (RAB). Agricultural challenges include limited use of fertilizer, improved seed and pesticides due to low supply, poor distribution network and high cost; poor quality of output leading to high post-harvest losses due to lack of markets. Limited irrigated land and weak meteorological capacity exposing the agriculture sector to weather-related risks; and limited value-addition and commercialization (only 2% of small enterprises engage in agro-processing) due to lack of business skills and poor infrastructure especially finance and transport in the rural areas (IPAR, 2009).

South Sudan: South Sudan is a landlocked country and borders Sudan from the north, Ethiopia from the east, Kenya, Uganda and the Democratic Republic of the Congo from the south and the Central African Republic from the west. The range has an equatorial climate and had dense montane forests supporting diverse wildlife. In recent years the rich ecology has been severely degraded by forest clearance and subsistence farming, leading to extensive erosion of the steep slopes. South Sudan has emerged from the two-decade civil war that left the country's infrastructure, including the well-established agricultural research centers under the national government, dilapidated. Over 80 percent of South Sudan population is engaged in agriculture, mainly for subsistence, producing only about 1.5 metric tons of food per household per year. The nation has set a strategy to revive the sector.

Tanzania: Tanzania is situated 6°00S 35°00E with a total area of 947,300 km^2 of which land is 885,800 square kilometres. About 12.25% of land area is arable arable with permanent crops occupying 1.79%, and others about 85.96%. The country is well supplied with fresh water bodies occupying an area 61,500 square kilometres with a total renewable water resource of 96.27 cubic kilometres. Irrigated land is estimated at 1,843 square kilometres. The terrain consists of plains along the coast, central plateau and highlands in the north and south. Natural hazards include flooding on the central plateau during the rainy season, drought and volcanism. Environmental challenges include soil degradation, deforestation, desertification, and destruction of coral reefs that threaten marine habitats. The reasons for the generally slow pace of agricultural sector development in Tanzania are outlined in the Tanzania Agricultural and Food Security Investment Plan (TAFSIP, 2011 – 2021).

Zambia: Zambia is a landlocked country in south-eastern Africa covering an area of 752,614 km2. The country lies mostly between latitudes 8° and 18°S, and longitudes 22° and 34°E. The neighbouring countries are the Democratic Republic of the Congo to the north, Tanzania to the northeast, Malawi to the east, Mozambique, Zimbabwe, Botswana and Namibia to the south, and Angola to the west. It has a tropical climate and consists mostly of high plateau, with some hills and mountains, dissected by river valleys. The country is prone to both droughts and floods, it also has some of the highest HIV/AIDS rates in the world. Such challenges have depleted the assets of farmers and left many facing hunger (FAO, 2013)[6]. Agriculture employs over 70% of Zambians. However, agricultural development is hampered by a number of factors including land constraints that adversely affect productivity and ability to effectively participate in agricultural supply chains, severely degraded soils, increasing costs of fertilizers and other agricultural inputs, poor transport infrastructure, and poor government policies that exclusively focus on maize at the expense of crop diversification. Improving access to land among the most land-constrained smallholder households has been suggested as a seemingly effective way to reduce poverty in Zambia.

[6] http://www.fao.org/isfp/country-information/zambia/en/

4. EVOLUTION OF THE AGRICULTURAL INNOVATION SYSTEM IN THE REGION

The endorsement of the CAADP framework by African Union Assembly in 2003 marked an important milestone in Africa's agricultural development. As the first African-owned initiative, the CAADP heralded an era of shared vision for continental agriculture, provided a framework for collective continental action, and introduced indicators for peer monitoring of progress towards agreed growth targets. Prior to the CAADP, agricultural development initiatives were piecemeal, uncoordinated, and largely promoted by donor agencies whose perception of development needs did not necessarily match those of Africans.

As an example of institutional innovation triggered in the CAADP dispensation, we depict in Figure 1 the evolution of regional agencies for implementation of CAADP Pillar. Advocacy campaigns for an African-led institution by the pre-existing sub-continental organizations, ASARECA (formed in 1994) and CORAF/WECARD (formed in 1987), led to the formation of FARA in 2002 as a successor to the Special Program on Africa's Agricultural Research (SPAAR). Since then, FARA – as Lead Institution mandated by AUC/NEPAD and sub-regional stakeholders - orchestrated the formation and strengthening of a formidable African stakeholder base to support implementation of CAADP Pillar IV. These are: Pan African Farmers' Organization (PAFO); Pan African Non-Governmental Organization Consortium (PANGOC); Council for the Coordination of Agricultural Research and Development in Southern Africa (CCARDESA); North Africa Sub-regional Organization (NASRO); Tertiary Education for Agriculture Mechanism-Africa(TEAM-Africa); the African Forum for Agricultural Advisory Services (AFAAS); and the Pan African Agribusiness and Agro-industry Consortium (PanAAC).

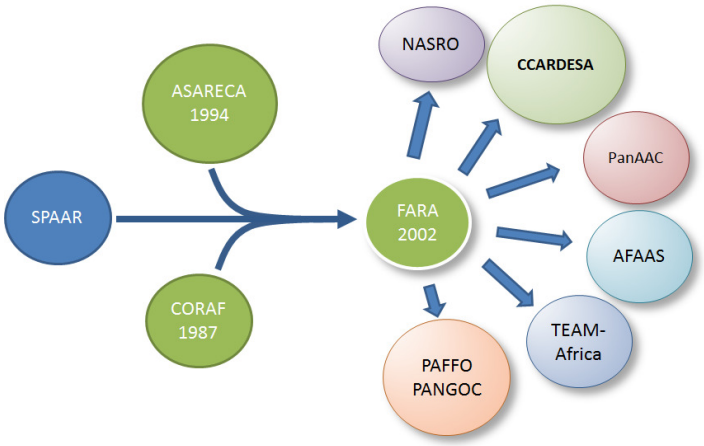

Figure 2: FARA's Origins and CAADP Pillar IV Stakeholders

This effectively defined an African continental agricultural innovation system comprising the key knowledge domains, viz.: *research* (ASARECA, CCARDESA, CORAF/WECARD, and NASRO), *tertiary agricultural education and training* (TEAM-Africa), *extension and advisory services* (AFAAS), *private sector and agribusiness* (PanAAC), *farmers* (PAFFO), and *other non-state actors* (PANGOC). Like in any innovation system, the continental agricultural innovation system requires lateral coordination, brokerage, and facilitation of the respective actions by constituent stakeholder organizations to ensure functional synergy. Currently, there is no clearly designated regional agency to play these roles, although FARA has pitched a strategic focus along these lines in its Medium Term and Operational Plan (2014 – 2018).

In parallel with institutional developments at continental level, there has been a corresponding evolution of agricultural knowledge frameworks at the national level. Previously, based on the national agricultural research system (NARS) concept, the national agricultural research institutes (NARIs) were the epicentre of agricultural innovation. Technology generation was the focus and technologies thus generated were then extended to farmers for adoption. This linear mode of technology transfer has since been faulted for the low adoption rates of agricultural technologies and the ailing state of Africa's agriculture. Subsequently, with the introduction of the regional agricultural productivity programs, starting with the West African

Agricultural Productivity Program (WAAPP) in 2007 and later the East Africa Agricultural Productivity Program (EAAPP), the Agricultural Knowledge and Information Systems (AKIS) paradigm came into play. In addition to technology generation, the AKIS also advocated for special information channels for technology dissemination. This brought the end user of agricultural technologies into perspective, albeit still passively. The main actors under AKIS are the NARIs, universities and extension agencies.

It is increasingly realized that research, education and extension alone are insufficient to bring knowledge, technologies and services to end users to help them innovate (Rajalahti, 2012[7]). In addition, contemporary challenges to agricultural development (e.g. climate change, globalizing markets, environmental degradation, sustainability issues, demographic transition, and urbanizing populations) defy conventional approaches to solutions. This has stimulated a systems-thinking orientation and the consequent elaboration of agricultural innovations systems (AIS) perspective. The AIS advocates for generation, dissemination and application of new knowledge and technologies, and gives prominence to the role of markets and market actors. It recognizes the transformative evolution of agricultural sector institutions each potentially bringing to bear unique knowledge capabilities on innovation processes. The approach takes into account the varied actors, their potential interactions, the role of informal practices in promoting innovation and the policy context (Rajalahti, 2012). However, practical application of the AIS perspective in national agricultural strategies is still in the initial stages and (as discussed in Section 5) only a limited number of stakeholders play an overriding role in bringing about innovations in majority of African countries.

In Southern Africa, the AIS concept was introduced by FARA's programme on Strengthening Capacity for Agricultural Research and Development (SCARDA) that sought to strengthen the human and institutional capacity of selected organizations in Lesotho and Zambia between 2008 – 2010. In West Africa, SCARDA also introduced AIS thinking in The Gambia around the same time. Other programs that have focused on promoting AIS in Africa include DfID's Research-into-Use (RIU) implemented in Rwanda and Malawi and FARA's Sub-Sahara Africa Challenge Program (SSA CP) on Integrated Agricultural Research for Development (IAR4D) implemented in Rwanda and Zambia. Both RIU and SSA CP programs advocate for innovation platforms (IPs) along value chains.

Since its introduction in 2007, the West Africa Regional Productivity Program (WAAPP) has promoted technical innovations on country-designated crops in the region based on the concept of regional centres of excellence. However, realization of the WAAPP goals is still elusive largely due to inadequate regional engagement frameworks and alignment of national policies for supra-national cooperation amongst participating countries[8]. Similarly, due to potential economies of scale, the supra-national organization for the East and Central African sub-region – ASARECA – is promoting regionalization of R&D and establishment of regional centres of excellence. To this end, the establishment of the Biosciences eastern and central Africa Hub (BecA) at the International Livestock Research Institute (ILRI), in Nairobi, Kenya, in 2010 was a key milestone. The BecA Hub is a regionally shared platform serving to increase access to affordable and state-of-the-art research facilities for technical innovations in agriculture and biosciences. Through the East African Agricultural Productivity Program (EAAPP), ASARECA is also promoting establishment of commodity-based centres of excellence in designated ECA countries. The EAAPP, the first phase of which is from 2010 to 2014, seeks to invest in regional approaches to agricultural research by supporting the strengthening and scaling up of agricultural research in eastern Africa, focusing on dairy, wheat, cassava and rice. Whereas the dairy sub-sector has recorded impressive gains in some ECA countries, production of wheat, cassava (particularly plagued by the recalcitrant mosaic virus) and rice are still below the sub-regional demand.

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[7] Rajalahti, R. (2012). Sourcebook overview and user guide. In, *Agricultural Innovation Systems: An Investment Sourcebook*, The World Bank, Washington, D. C. pp. 1 – 14.

[8] Ojijo, N. K. O., Annor-Frempong, I., and Kaufman, V. R. (2010). Capacity Strengthening for Regional Agricultural Innovation: The Case of The West Africa Agricultural Productivity Program (WAAPP). FARA, Accra, Ghana. http://www.academia.edu/1392660/Capacity_Strengthening_Components_of_the_WAAPP

The development of the New Rices for Africa (NERICAs) by AfricaRice in 1990s was a landmark innovative breakthrough that promised to boost yields and make Africa self-sufficient in rice production. According to AfricaRice[9], large-scale diffusion of NERICA in Benin has contributed to poverty alleviation. Increased yields due to NERICA adoption by Beninese farmers has increased women farmers' incomes by USD$337 per ha of NERICA cultivated. Elsewhere, however, field performance of NERICA has been less than impressive and the cultivar has not been widely adopted by farmers perhaps due to the variable adaptability of NERICA lines to differing agro-ecologies and inappropriate adoption strategies.

[9] http://africarice.org/publications/brochure

5. KEY ACTORS, THEIR ROLE AND FACTORS ENABLING INNOVATION

Historically, public sector organizations (i.e. research institutes, extension agencies, and universities) have led innovations in agricultural technologies to address country-specific challenges. In the African context, minimal gains in smallholder productivity under the linear mode of technology transfer have inspired a systems perspective to actor engagement in the agricultural sector. Also, the emergence of regional agricultural sector policies as well as supra-national approach to tackling agricultural challenges have increasingly contributed to greater involvement of non-state actors in agricultural innovation processes. This section presents an inventory of actors, their roles, power, level of involvement in agricultural innovations and the mechanisms for their interactions in a bid to understand the functionality of innovation systems in the African TAP countries.

5.1 Types of Organizations involved in Agricultural Innovations

Appendix 3 summarizes the major actors in the agricultural sector of tropical African countries targeted in this review, including their roles and behaviour.

5.1.1 Agricultural research organizations

In all the countries, the national agricultural research institutes (NARIs) are the lead agencies for agricultural innovation, commanding 50 - 75% of the share of national budget allocated to agricultural R&D expenditures. Examples of the NARIs in the reviewed countries include: the Agricultural Research Institute of Mozambique (IIAM); Rwanda Agricultural Board (RAB); the Environment and Agricultural Research Institute (INERA) of Burkina Faso; Department of Research, Training and Extension (DRTE) in Tanzania; Niger National Institute of Agricultural Research (INRAN); Department of Agricultural Research (DARS) in Malawi; Ethiopian Institute of Agricultural Research (EIAR); Zambia Agricultural Research Institute (ZARI); Benin National Institute of Agricultural Research (INRAB); Agronomy Research Institute (IIA) and Veterinary Research Institute (IIV) in Angola; National Agricultural Research Institute in The Gambia; Lesotho Centre for the Coordination of Agricultural Research and Development (LECCARD) in Lesotho; and Central Agricultural Research Institute (CARI) in Liberia. All these institutes are associated with the line government ministries (e.g. Ministries of Agriculture and Livestock) in their respective countries that define policies and allocate budgets. In South Sudan, there is no functional national agricultural research institute; agricultural research is scattered in the three Ministries of Agriculture, Forestry, Cooperatives and Rural Development (MAFCRD); Ministry of Environment; and Ministry of Animal Resources and Fisheries. A directorate in each of these ministries coordinates research relevant to the ministry's focus without any lateral coordination between them (Kibwika et al, 2013). In Liberia, CARI facilities are presently occupied by UNMIL and there is minimal research activity.

Functional research collaborations between the public research institutes and other local research agencies, universities, private sector, and farmer groups were not apparent in the majority of the countries. With the exception of Zambia, non-state actors contributing to agricultural research were virtually non-existent in the other reviewed countries. Among the countries targeted for this review, Rwanda has a relatively more integrated public agricultural research system with organizations that specifically focus on promotion of knowledge acquisition, knowledge creation, knowledge transfer and a culture of innovation. The key innovation institutions in Rwanda include the Centre for Innovation and Technology Transfer (CITT) and the Institute for Scientific Research and Technology (IRST). Further, RAB's research directorate is responsible for overall coordination of countrywide agricultural research activities and driving science-based technology generation for sustainable agricultural development. The research directorate at RAB conducts research and promotes technologies in crop production, livestock, forestry, agroforestry, post-harvest management, land conservation and water management. It also promotes stronger synergies between research and extension to ensure that technologies developed are disseminated to end users. The RAB uses innovation platforms (IP) approach, perhaps a legacy of FARA's SSA CP program piloted in this country, whereby stakeholders (farmers, scientists, traders, local authorities, NGOs and the private sector) are increasingly involved in the research process from priority setting and technology development to technology transfer.

There are also regional research centres in some countries, with Ethiopia having about seven Regional Agricultural Research Institutes (RARIs) located in various administrative regions of the country. These include Amhara Agricultural Research Institute (ARARI), Tigray Agricultural Research Institute (TARI), Oromiya Agricultural Research Institute (OARI), South Agricultural Research Institute (SARI), Gambella Agricultural Research Institute (GARI), Afar Pastoral Agro-pastoral Research Institute (APARI), Somali Pastoral Agro-pastoral Research Institute (SORPARI). Angola has the Chianga Experimental Research Institute, while Zambia has the Indaba Agricultural Policy Research Institute (IAPRI), among others.

In Tanzania, agricultural research is deconcentrated to the zonal level. Tanzania's main public agricultural research organization, the DRTE, coordinates seven deconcentrated Zonal Agricultural Research and Development Institutes (ZARDIs). There are also various national thematic and commodity research programmes and institutes – some are partly privatized (coffee, tea and tobacco), others have relative autonomy and are financed by the respective sectors. The ZARDIs have well-established working relations with farmer groups (farmer research groups – FRGs), farmer extension groups and farmer field schools (FFSs). Since 1998, farmers have been effectively represented on various zonal-level research planning committees (Lema and Kapange, 2006).

A recent assessment of agricultural innovation experiences in smallholder farming in African countries including Benin indicated that formal research did not initiate or play a leading role in many innovation cases. Rather, ideas and initiatives came from different sources, including farmers. Policymakers and private-sector actors did not feature among the active stakeholders, indicating a probable paucity of specific pro-innovation public policies in these countries. Further, farmer-led cases of multi-stakeholder interaction were rare; in many cases, one of the stakeholders (typically a research institute or an NGO) played the role of intermediary to facilitate interaction among the stakeholders (Triomphe et al., 2012[10]). In Ethiopia, there are research-extension councils that link farmers with technology providers.

Thus, majority of the African countries targeted by the TAP intervention have appreciable public organizational set-ups for agricultural research quite extensively devolved in some cases to sub-national levels for agro-ecological focusing and end-user proximity. However, save for isolated countries, the research agencies predominantly operate in 'silo' mode indicating the need for greater policy, research and end-user alignments. Moreover, the disproportionate allocation of public resources to public research institutes is an area for policy innovation to incentivize other potential contributors to agricultural research and technical innovations.

Moreover, a review by Beintema and Stads (2011) of African agricultural R&D over the last decade identified four key areas for policy actions, viz.:

a) Measures to counteract decades of underinvestment in agricultural R&D – this is in spite of the Maputo Declaration of 2003 that called on African governments to commit at least 10% of their annual budget to agriculture. To date, less than a handful of African countries have consistently met this target.
b) Addressing pervasive volatility in year-to-year spending on agricultural R&D – this is due to the fact that agricultural spending by African countries are invariably supported by foreign aid flows based on short-term planning horizons. There is need for increased mobilization of local resources to support long-term R&D forecasts.
c) Addressing the dearth in human resource capacity – critical stock of high calibre human capital is needed to generate innovations for tackling agricultural development challenges and to implement the CAADP. This is threatened by outdated curricula, not-so-good students choosing

[10] Triomphe, B., A. Waters-Bayer, A. Floquet, G. Kamau, B. Letty, S. D. Vodouhe, T. Ng'ang'a, J. Steens, J. van den Berg, N. Selemna, B. Bridier, T. Crane, C. Almekinders, N. Oudwater, H. Hocdé (2012). Joint learning to enhance innovation systems in African agriculture. A report of a Conference on International Research on Food Security, Natural Resource Management and Rural Development organised by Georg-August Universität Göttingen and University of Kassel-Witzenhausen. Tropentag 2012, Göttingen, Germany, 19–21 September 2012.

agricultural courses as a last resort, reduced postgraduate training (MSc and PhD levels), aging researchers, and brain drain.

d) Harnessing supra-national cooperation in agricultural R&D – this could be promoted through various means including:
    a. Regional and sub-regional resource pooling (i.e. through centres of excellence and the CGIAR) to address trans-national R&D issues;
    b. Policies encouraging scholar mobility for capacity support and backup to less endowed countries (e.g. post-conflict and protracted crises countries); and
    c. Competitive grant schemes to encourage collaboration around key issues within innovation systems perspectives.

5.1.2 Agricultural education institutes

Each of the reviewed countries had several tertiary agricultural education (TAE) institutes with Ethiopia having the largest number. By 2012, Ethiopia had eight institutes of higher learning in the field of agriculture and over 25 technical and vocational education and training (ATVET) colleges in agriculture, all funded and managed by the federal and/or regional governments (Spielman et al., 2012[11]). However, these agricultural education institutions tend to provide training and conduct research on traditional agricultural issues such as plant breeding, animal health and agricultural economics, with limited or no speciality courses on emerging issues like climate change, biotechnology, bio-energy, or food systems. Only the two universities in Benin, Abomey-Calavi and Parakou, focus on climate change variability and adaptation, while Abdou Moumouni University (UAM) in Niger conducts research in technology besides general agriculture issues. In South Sudan, Juba National University, John Garang Memorial University, and Upper Nile University are the three main public universities with functional Faculties of Agriculture, while Yei Agricultural and Mechanical University is the only privately founded university with an agricultural focus.

The TAE institutes contribute significantly to national agricultural research (up to 20% in some countries) with some having good collaborative linkages with local and international organizations (Appendix 3). Research funding is predominantly external, either by staff responding to local and international calls for proposals. However, the TAE involvement in national agricultural innovation policy formulation is still largely unstructured and research themes by faculty are not necessarily integrated with the national agricultural development priorities as espoused, for example, in the CAADP NAFSIPs. Further, the TAE institutes have the onus of strengthening the capacity of other actors (educators, extension agents, rural entrepreneurs, and small-scale farmers) in the national agricultural innovation systems to innovate. According to Spielman et al (2012), "TAE institutes should not only serve to expand a country's stock of trained human capital, but also play a role in building the capacity of organizations and individuals to explore new products and processes that depend on the transmission and adaptation of existing information. To do so, TAE systems should focus more on transforming organizational cultures and building innovation networks to strengthen innovative capabilities at both the institutional and professional levels. To this end, key policy reforms include the introduction of educational programs beyond the formal TAE system, and improvement of the incentives that encourage TAE professionals and organizations to forge links with other innovation system stakeholders".

A consortium of universities from West African countries, including Burkina Faso, recently conducted a collaborative study to determine 1) the position of universities in the national innovation system, 2) the status of national research policies, and 2) how universities interact with the other stakeholders. The study was not focused on agriculture per se, but identified the following issues and constraints that are pertinent to the agricultural sector (Frempong, 2013[12]):

- University-industry linkages are weak although in some cases university research contributes significantly to solving social problems;

[11]Spielman, D. J., K. Davis, E. Zerfu, J. Ekboir , and C.M.O. Ochieng (2012). An Innovation Systems Perspectives on Tertiary-Level Agricultural Education In Sub-Saharan Africa: Evidence From Ethiopia. Ethiop. J. Edu. & Sci., 7 (2): 15 – 32.

[12] Frempong, G. (2013). University Research Governance in West and Central Africa: Main Findings. Presentation at the 13th General Conference of AAU from 28th – 30th May 2013, Held at Hotel Okoume Palace, Libreville, Gabon.

- Most universities have internally generated funds for research, however not sufficient to support innovative research
- Absence of legal instruments for the establishment, accreditation and functioning of university research institutes/laboratories
- National Innovation Systems (NIS) in the West and Central African region are informal and not well developed
- Responsibility for national research is divided between several ministries
- There is collaboration between universities and research institutions in the sub-region and their international counterparts;
- Monitoring and evaluation mechanisms were lacking in the public universities
- Low research activities carried by private universities
- Valorisation of research output was very low

To address some of these constraints, the study recommended the following:

- Establishment of incentive schemes in most universities to facilitate research and capacity building through e.g. sponsorship for conference participation and grants for publication of research results
- Development of national science, technology and innovation policies
- Establishment Science, Technology and Innovation Fund

There is need for policy reforms both at national and organizational level to re-position agricultural education institutes so that they can effectively play their roles of producing the required human capital to move Africa's agriculture, undertaking innovative research, and developing the capacity of other national agricultural innovation actors. The recent formation of TEAM-Africa and the NEPAD's ATVET initiative are direct responses to this concern. Better engagement of agricultural education institutes in national development issues e.g. the CAADP Country Roundtable process is also called for.

5.1.3 Extension agencies

Agricultural extension services in post-independent African countries were provided mainly by government agencies. However, lack of funding due to structural adjustment policies led to a complete breakdown in government extension services in many countries. As a result, many non-state actors came into the fray to fill the void. An array of actors execute extension services in the reviewed countries ranging from specific departments in the agriculture ministries (e.g. MAFCRD's Directorate for Research, Training and Extension Service in South Sudan), independent government agencies, research-extension advisory councils, farmer-based groups, local and international NGOs (e.g. FARM Africa and Winrock International in Ethiopia).

In Rwanda, the Government has decentralized agricultural extension activities to the Ministry of Local Government (MINALOC) to improve efficiency in extension delivery and responsiveness to specific needs of farm households within each district. This move along with a redeployment of staff, especially Subject Matter Specialists (SMSs), should strengthen extension and enhance its role by positioning staff closer to the population they are intended to serve (see http://www.worldwide-extension.org/africa). Tanzania's extension system is similarly decentralized to the lowest administrative levels. Further, over 10 registered NGOs are actively involved in extension delivery in Tanzania, while donors like Sasakawa Global 2000 have joined up in capacity building for agricultural extension. The Sasakawa Africa Fund for Extension (SAFE) is also active in supporting public extension efforts in Mozambique, a country where private Joint Venture Companies (JVC) are also engaged in input supply, provision of technical advises to farmers associations and cooperatives, organizing farmers groups to facilitate export of commercial crops, and agro-processing and marketing of value added products.

In Benin, Burkina Faso and Niger institutional configuration for extension delivery is similar and mainly involves public agencies, farmer-based organizations, and NGOs. In Benin, university-based extension services (e.g. by the Université d'Abomey-Calavi, Faculté des Sciences Agronomiques) contributes significantly to public extension. Producer organizations in Benin also operate Information Platforms to deliver sub-sector- or value-chain-based extension. The Sasakawa Africa Fund for Extension Education

(SAFE) has programs in Burkina Faso in collaboration with the University of Bobo Dioulasso where a number of agricultural extension staff have been trained (http://safe-africa.net/Bobo%20Dioulasso.htm).

In some countries like Angola, Liberia and South Sudan, rural extension could play the double role of ensuring food production and facilitating peaceful co-existence. Internal conflicts in these countries are to some extent along ethnic lines, and government interventions may not always be deemed impartial. Extension agents can double up as brokerage agents facilitating self-organization of farmer groups to better articulate their demands, accelerate adoption of improved production practices and improve access to financing and markets. This role of organizing farmers to address shared problems provides an opportunity for using extension agents to embed peace-building capacity deep in rural communities (Robertson, 2013[13]). Favourable policy frameworks at regional and national levels can help redefine extension delivery and favour the operation of independent and neutral extension agents to mediate in conflict situations. To this end, the Government of South Sudan and its constituent states are jointly developing an integrated extension system.

In Lesotho, public-funded farmer training centres provide regular updates through publications and radio broadcasts on agricultural production and marketing issues. Moreover, in Rwanda, Benin, Mozambique and Ethiopia there is emphasis on use of 'advisory services for family farms'. Through programmes that promote farmer participatory research (e.g. FARA's SCARDA programme), countries like Lesotho have managed to embrace multi-faceted extension involving university-ministry-research collaboration to promote livelihoods and income-generating programs. Other regional programs like AfricaAdapt (http://www.africa-adapt.net/) share knowledge and information to farmers regarding climate change adaptation using alternative extension methods and communication technologies.

Demographic changes, lack of personnel to undertake rural extension (occasioned by the prevalence of HIV/AIDS and rural-urban migration), and poor access to rural areas due to bad road infrastructure necessitate innovations on new methods and models for rural extension, notably using ICT-based solutions. Prospects for e-extension are brightening by the day as farmers even in far-flung rural Africa continue to own mobile phones. In a few countries, extension services are increasingly being integrated in commodity value chains through innovation platforms promoted by various continental programs like RAILS, DONATA and SSA CP. FARA is currently collaborating with University of Nebraska, Lincoln, to pilot an eXtension program in Ethiopia and Zambia. The program seeks to create an eXtension hub to improve communication and agricultural dissemination among researchers, educators, and farmer communities. The eXtension hub will link with each of the projects in the partner countries, the Forum for Agricultural Research in Africa (FARA) and the University of Nebraska-Lincoln (UNL) consortium to enhance collaboration and the dissemination of agricultural knowledge.

The policy framework on extension delivery was not very clear in most of the countries. In Rwanda, which is an example of a good policy environment, the Ministry of Agriculture (MINAGRI) elaborated a National Agricultural Extension Strategy (NAES) in 2009 and concomitantly enacted institutional transformation to link research and extension by creating the Rwanda Agricultural Board (RAB) and the National Agricultural Export Board (NAEB) out of previously separate agencies within MINAGRI. However, there are unclear provisions for interfacing between extension agents in the two line ministries, MINAGRI and MINALOC (Ministry of Local Government). Moreover, the NAES neither explicitly provides for involvement of public tertiary agricultural education institutes and non-state players in developing capacity for extension nor with the Ministry of Information and Communication Technology (MINICT) to develop e-extension capabilities. Invoking innovation systems thinking can help develop a more integrated and effective framework for extension delivery in the TAP target countries.

State actors that report to line ministries conduct advisory and extension services in majority of the reviewed countries. However, due to widespread resource limitations by governments in many of the

[13] Robertson, A (2013). A New Opportunity: Agricultural Extension as a Peacebuilding Tool. Available at: Http://Www.Usip.Org/Publications/New-Opportunity-Agricultural-Extension-Peacebuilding-Tool . Accessed on 28th April 2013.

countries, extension coverage cannot be extensive. Private sector intermediaries (usually agrochemical companies and input suppliers), NGOs, and organized farmer groups often fill the surplus demand for agricultural extension. Nevertheless, most advisory services lack clear dissemination approaches that would effectively reach smallholders. The policy domain has also not sufficiently enabled the engagement space by private actors. Moreover, poor rural infrastructure in many countries renders farmers inaccessible to advisory services and none of the countries reviewed had exploited the enormous opportunities offered by ICT for extension. This is a clear case for convergence of agricultural, information and communication ministries to broker innovations in e-extension. In all the countries, mobile phone ownership is beyond 70% even in remote rural locations. If money is accessible via mobile phones in these remote points, surely can extension advice.

5.1.4 Commodity-based organizations

Commodity-based organizations (CBOs) also undertake agricultural research and extension in some countries. Indeed, CBOs were the primordial agricultural research agencies as these countries gained independence and continue to be enduring relics from the colonial agricultural research policies. Examples of CBOs active in the reviewed countries include: the Fisheries Research Institute (IIP) in Mozambique, Applied Science and Technology Research Institute (IRSAT) and National Forest Seed Centre (CNSF) in Burkina Faso, Cotton Development Trust (CDT) in Zambia and Malawi, Central Veterinary Research Institute (CVRI) in Zambia, the Veterinary Research Institute (VRI) in Angola and the Livestock Multiplication Centre (CMB) in Niger. Tanzania has over six commodity-based research institutes, namely the Tanzania Coffee Research Institute of Tanzania (TACRI), Tobacco Research Institute (TORITA), Tea Research Institute of Tanzania (TRIT), Tanzania Forestry Research Institute (TAFORI), Tanzania Fisheries Research Institute (TAFIRI) and Tropical Pesticide Research Institute (TPRI). Often, funding for research and extension services by the CBOs are internally generated from commodity sales and the government only plays the role of a regulator. Research themes are often in response to specific commodity concerns emanating from farmers and agribusinesses. Most of the CBOs have well-developed value chains and provide an integrated range of services from input supplies, extension, technical advice, research, processing and marketing.

5.1.5 Producer organizations

The last few decades has seen the proliferation of producer organizations in Africa, much in tandem with the evolution of sub-regional agricultural research organizations. Currently, we have the Network of West Africa Peasant and Agricultural Producers' Organizations (ROPPA) in West Africa, the Sub-regional Platform of Peasant Organizations of Central Africa (PROPAC) in Central Africa, the East African Farmers' Federation (EAFF), North African Farmers Union (UMAGRI), and the Southern African Confederation of Agricultural Unions (SACAU). The five sub-regional networks have agreed to establish a pan-African platform of farmers' organizations and agricultural producers known as Pan African Farmers' Organization (PAFO). Producer organization networks have been more involved in dialogue about agricultural policy than about agricultural investment, particularly at the regional than at the national level.

At country level, the regional producer organizations have succeeded to an appreciable extent in securing famer representation in the CAADP roundtable processes (McKeon, Undated[14]). However, producer organizations do not appear to be actively engaged in determining research and extension priorities, except in some isolated cases. This is mainly due to lack of capacity for demand articulation by farmer representatives and poor representation of farmer groups in national policy processes. In Rwanda, implementation of FARA's Sub-Saharan Africa Challenge Program (SSA CP) in the Lake Kivu region has encouraged viable interactions between research, agribusiness, extension, and smallholder farmers based on the principles of integrated agricultural research for development (IAR4D). SSA CP has enabled formation of innovation platforms (stakeholder collaborating entities) along specific commodity value

[14] McKeon, N. (Undated). Promoting Involvement of Producer Organizations (POs) in the Design and Formulation of Agricultural Investment Programmes in Africa. TCI Discussion Paper

chains. In Benin and Tanzania, NGO agencies have fostered farmer-to-farmer linkages and knowledge sharing on farm-to-market innovations. Benin also has relatively more organizations that support smallholders through capacity building and development of their natural resources. With respect to innovation development, the main producer organization in Benin (FUPRO) aims to facilitate the exchange of information between member unions and producer organizations, stimulate farmer-led action research, serve as an information centre for members, train members and represent them in R&D organizations. FUPRO, producer unions, extension service providers and cotton ginners meet twice a year to discuss the planning for multiplying and distributing cottonseeds to farmers.

South Sudan is rebuilding its farmers' unions from scratch starting with the initial stages of the formation of farmer groups. Expertise on strengthening of associations is highly limited. Farmer groups are fast developing in some Counties and at state level, but all these organizations are still very fragile. Organized support service to smallholder farmers both by public and non-state actors is still rudimentary, although a number of NGOs (e.g. the CRS) operate in South Sudan providing borderline agricultural services.

However, still much needs to be done to ensure involvement of producer organizations in the design, implementation and monitoring of agricultural investment programmes. Such involvement is necessary in order to improve the relevance of programmes by accurately identifying the needs and constraints of farmers (Mckeon, Undated). Other challenges may include perceived weaknesses of the producer organizations. In this case, the organizations may not represent the true interests of rural population, who are the least likely to be organized. An inevitable knowledge and information gap always exists between the apex organization/national platform and the base. Political persuasions may compromise the extent to which apex leadership represents grassroots interests. Often the apex organizations/national/regional platforms do not have sufficient capacity for strategic analysis to allow them to participate effectively in project preparation.

As provided in the Framework for African Agricultural Productivity (FAAP), FARA has supported the formation of farmer-based organizations at continental and sub-regional levels. However, the formation and leadership of farmer groups at national and sub-national levels is often spurious and unrepresentative. Furthermore, the regional FBOs are predominantly foreign funded, their accounts rarely audited, and the constituencies that they purportedly represent do not necessarily sanction their activities. This lack of financial and operational accountability leaves room for institutionalized malfeasance. As noted earlier, there is apparent activity by FBOs at regional level with little cascading of actions to the grassroots. Effective end-user participation in agricultural innovation processes will only be possible if there are clear guidelines for representative self-organization (the enabling environment) and adequate individual and organizational capacities and channels for better demand articulation with the various innovation actors e.g. policy makers, researchers, education institutes, and extension workers.

5.1.6 Private sector organizations

In a survey conducted by FARA in 2012 in four countries including Zambia (see respondent summary in Table 1), respondents indicated increased private sector participation in all aspects of agriculture, but the mechanism for doing this was unclear (Utiang, 2013[15]).

Table 1: Survey of the national agricultural innovation systems in four African countries - Summary of respondents

Stakeholder Category	Botswana		Ghana		Kenya		Zambia	
	Open-ended	Survey	Open-ended	Survey	Open-ended	Survey	Open-ended	Survey
Policy, Ministry of Agriculture, Planning Commission	3	6	1	1	2	1		

[15] Ugbe, U. (2013). An Assessment of National Agricultural Innovation Systems in Botswana, Ghana, Kenya and Zambia. A draft survey report submitted to FARA, unpublished.

Agric Extension (public sector led)	4	3	1	4	1	1	1	2
Agric Extension (private sector led)			1				3	1
Agric Research, Training/Education	4	7	7	4	3	8	4	7
Private Sector, Agro-allied business, MSMEs, Banks/financial service providers	7	10	2	6	1	2	4	3
Civil Society; NGO/CBO Service Provider							4	
Total*	**18**	**26**	**12**	**15**	**7**	**12**	**16**	**13**

The policy documents appeared to assume that the private sector will invest and thereby raise the economic viability of the struggling subsectors. On the contrary, the representatives of private sector stakeholder groups who participated in key-informant interviews, said that the best way of attracting private sector investment to any agricultural subsector was to demonstrate the potential economic viability and profitability of the subsector. Some respondents called for protocols that would incentivize private investment in the various subsectors. The survey respondents suggested development of memoranda of understanding (MoUs) to safeguard the intellectual property of researchers who collaborate with the private sector. The provision of essential public infrastructure (roads, electricity, telecommunications, healthcare, and education services) in rural areas would help in reducing the cost of doing agribusiness in rural areas, supporting rural-based small-scale agribusiness and related entrepreneurial activities, and discouraging rural-urban migration in order to guarantee the availability of labour in the rural economy.

A survey conducted by the Pan African Agribusiness and Agro-industry Consortium (PanAAC) in 2011 amongst small and medium enterprise (SME) agribusinesses that operated in agricultural value chains in various countries including Tanzania and Zambia identified the following challenges:

a) Most of the agribusinesses operate as partnerships and sole proprietorships and lack definite legal personality. This prohibits them from accessing external financing and other business support services. To enhance their accessibility to essential services, reduce vulnerability to lawsuits, protect personal assets of the shareholders, and ensure continuity beyond managerial circles and employee turnovers, the businesses would need support to transform into limited liability companies.
b) Majority of the agribusinesses surveyed were start-ups that had been operational for less than 10 years. They indicated *individual, institutional and enabling environment* capacity constraints including inability to create strong brands, lack of innovative product offerings, inability to compete effectively with well-established firms, high operation costs, poor customer service, instability of product prices, ineffective marketing strategies, weak operating systems, and inadequate financial resources. Further, unskilled workforce characterized the enterprises with only 61% employing university graduates.
c) As SMEs, the agribusinesses did not have in-house capacity to undertake research and development. To innovate, they have to rely on new knowledge generated from external sources. However, limited access to new ideas (perhaps due to lack of specific engagements or alliances with research organisations to foster acquisition of such new knowledge), lack of incentives to experiment new ideas, inadequate human and financial resources, inadequate internal capacities and expertise to experiment the new ideas, and unfavourable policies and procedures undermine their knowledge-tapping capacity.

The study suggested the creation of platforms to promote innovations through consultations, partnerships and interactions between the agribusinesses on one hand and universities and research institutes.

It appears that policies on private sector engagement are misaligned with stakeholder expectations and there is lack of formal engagement protocols with the private sector. Other issues to do with enabling environment such as market access[16], IPR regimes, taxation, provisions for remitting profits, costs of

[16] For example, there would be no incentive to innovate in the area of biofuels if there are no policies for biofuel use. In Brazil, government policies make it mandatory to incorporate of a given proportion of bioethanol in gasoline. The ready market resulting from such a policy is a powerful incentive for innovations in bioethanol production and internal combustion engine technologies.

innovation[17], and ease of doing business also influence private sector engagement in agricultural innovation processes. Further, the operational domain of private sector players currently seems to be limited to agribusiness (i.e. input supplies, agro-processing and produce marketing). Yet, there is scope for increased involvement in research, provision of education services, extension and policy formulation. Even in agribusiness, the main players are mostly foreign-owned multi-national firms. Development of a vibrant agribusiness in African countries depends on the success of locally owned SMEs. This necessitates appropriate legal and financial policies to encourage proliferation of SMEs (possibly under the TAP Policy Dialogue component) coupled with capacity development of SME investors to help them better manage their businesses.

5.1.7 Agricultural Finance Organizations

5.1.7.1 Africa Rural and Agricultural Credit Association

Access to financial services in the agricultural sector would enhance a market-led approach, commercialization, value addition, technology adoption, access to markets and services, and agribusiness expansion. The Africa Rural and Agricultural Credit Association (AFRACA) is a Pan African Association of financial institutions involved in promoting provision of financial services to rural populations in Africa. Founded in 1977, AFRACA currently has nearly 100 members in over 30 African countries comprising Central Banks, Commercial Banks, Agricultural Banks, Microfinance institutions (MFIs) and their networks. The mission of AFRACA is "to improve the rural finance environment through the promotion of appropriate policy framework and to support member institutions to provide sustainable quality financial services to the rural population". AFRACA works in partnership with its members, research institutions and development partners to increase rural outreach and to improve provision of financial services through more appropriate banking practices and innovative financial products. AFRACA also works in the areas of strengthening agricultural finance policy and enhancing the capacities of member institutions to provide quality sustainable financial services. AFRACA's partners include IFAD, Technical Centre for Agricultural and Rural Cooperation (CTA), DANIDA, FAO and USAID among others. Over the years, AFRACA has hosted platforms and forums to broker innovative solutions to agricultural value chain financing.

5.1.7.2 Technoserve

Some NGOs have also been successful in promoting innovative financing solutions to farmers. In Tanzania TechnoServe has been working with local and international financial institutions to design financial products that serve smallholder coffee farmers across the entire value chain. These products range from short-term input credit and sales pre-financing to multiyear loans used by farmers to invest in centralized processing facilities. Credit is guaranteed through a variety of innovative means, including private guarantee funds, warehouse receipts, and forward sales to specialty coffee buyers. TechnoServe has also been involved in institutional transformation of the coffee industry in Tanzania, having helped form KILICAFE, an organization now owned by 9,000 smallholder farmers and markets over $3M of smallholder coffee per year.

5.1.7.3 African Guarantee Fund

Launched by the African Development Bank (AfDB) at its Annual Meeting in Arusha, Tanzania, in 2012, the African Guarantee Fund is a market-friendly guarantee scheme aimed at easing access to finance for African SMEs[18]. The AGF will provide partial credit guarantees and capacity development for financial institutions in African countries to better serve the needs of SMEs. Through these activities, the Fund hopes to improve SME financial product offerings, expand bankable SME segments, and increase Banks' capacity to appraise SMEs. The AGF products will be piloted in 14 African countries in the first two years and hopes to cover the entire continent within four years. The Phase 1 countries, characterized as 'transition economies' in terms of economic diversification and export orientation, include the TAP target countries of

[17] http://www.syngentafoundation.com/content/api/org_files/policy_text_6_march_12_2012.pdf.

[18] http://www.afdb.org/en/topics-and-sectors/initiatives-partnerships/african-guarantee-fund-for-small-and-medium-sized-enterprises/ Accessed on 4th August 2013)

Tanzania Mozambique and Zambia. However, the degree to which the AGF will benefit agribusiness SMEs is unclear as there are no special sectoral provisions.

Some general agricultural value chain financing issues to be addressed include (Miller and Jones, 2010[19]):

a) Need to reform regulatory frameworks by governments so as to create opening for innovative financial products such as leasing, factoring, bond issues, certificates of deposit, futures exchange, and parametric insurance, payment systems that recognize electronic currency, and credit reporting agencies
b) The need to improve information flows and partnerships between financial institutions with other stakeholders or value chain actors
c) The need for an up-to-date Market Information System to facilitate exchange of market information
d) Developing farmers' capacity to be able to effectively apply technical requirements and make the most of administrative and financial facilities to enable them add value to their output
e) Capacity development on strategic partnership and relationship building for major actors along the agricultural value chain
f) Need to focus financing on downstream activities such as market network, processing, and exporting where significant values are added to the chain while at the same time taking care of the weakest part of the chain by empowering actors at this level.
g) Need for long-term forecasting of agricultural policies to stabilize investments

There is need for policies that promote shared risks amongst value chain players to guarantee financing. Other instruments, such as warehouse receipts require regulatory revisions for the acceptance of new forms of collateral, as well as having in place grading standards and adequate storage facilities (Miller and Jones, 2010). Further, the devastating effects of climate change increasingly plague agriculture in Africa and farmer insurance is becoming a big issue. Insurance has been dubbed the game changer that makes farmers to invest. Yet, no insurance actors were identified in the cast of organizations and entities supporting the agricultural sector in all the 15 countries. These are critical areas for stimulating smallholder agriculture and should therefore be the focus for urgent institutional innovations. The establishment of Africa Risk Capacity by AU/NEPAD at the continental level is a timely institutional progress; but the effort would have to trickle down to the national level for the benefit of smallholders.

5.2 Institutional Power and Level of Involvement in Agricultural Innovations

Since 2000, national-level agricultural R&D in SSA has become increasingly interlinked. Working closely with FARA, the three SSA sub-regional organizations (ASARECA, CORAF/WECARD and SADC/FANR Directorate (now CCARDESA)) coordinate agricultural research activities in their member countries through the establishment of various research networks. These networks promote collaboration and information sharing, development of centres of excellence in designated fields and commodity areas, and support to training and R&D for neighbouring countries with less developed capacity.

As alluded to In Section 5.1, public institutions are responsible for over 70% of agricultural research and technology generation in most African countries. The share of private sector research contribution is a paltry 2% of total investments in agricultural R&D. Power dynamics, often dictated by political-economy underpinnings, influence the relative contribution to agricultural innovations among the public institutions. Institutions controlling less than 25% of R&D expenditure are considered to have low power, those accounting for between 25% to 50% of research budget are deemed to have medium power, while those that manage over 75% of national R&D budget are considered to have relatively high power in the innovation process.

[19] Miller, C. and Jones, L. (2010). Agricultural Value Chain Finance: Tools and Lessons. FAO, Rome, Italy.

However, the number and types of initiatives that the institution generates or coordinates determines its actual innovativeness. As indicated in Table 2, Rwanda's two institutions (CITT and IRST) under the Ministry of Education, Science, Technology and Scientific Research and RAB have the highest power and level of involvement in agricultural innovation.

Table 2: Power analysis and level of institutional involvement in innovations[20]

		Level of actor involvement in NAIS (1= very involved, 5= very little involved)				
		1	**2**	**3**	**4**	**5**
Power of actor	**High**	CITT, IRST, RAB (Rwanda)		IIAM (Mozambique), INERA (Burkina Faso)	INRAN (Niger)	
	Medium	FARA, ASARECA, SADC, CIAT, ICRISAT, CIMMYT, DFID	UAM (Niger), CDT-Malawi, RARIs in Ethiopia	INRAB (Benin), most universities	ZARI, IAPRI (Zambia)	
	Low		MVIWATA (Tanzania), IMBARAGA (Rwanda), FUPRO (Benin)	IIP (Mozambique), CABI (Tanzania), EIAR (Ethiopia), IITA, SNV, FARM Africa	CNSF, IRSAT (Burkina Faso), TaCRI, TORITA, TRIT, DRD, DRTE(Tanzania), CMB (Niger), CVRI, CDT-Zambia, MINADER (Angola), UEM (Mozambique), IDR (Burkina Faso)	

Producer organizations especially FUPRO in Benin, MVIWATA in Tanzania and IMBARAGA of Rwanda also have considerable level of involvement in innovations despite having limited control of the national research funding and policy processes. This is due to their direct engagement with farmers at the local level. In addition, institutions that fund or actively participate in formation of IPs, for instance FARA, ASARECA, SADC, International Centre for Tropical Agriculture (CIAT), ICRISAT, CIMMYT and DFID have medium power but high involvement in the innovation process. Ethiopia's RARIs, Malawi's CDT and the Abdou Moumouni University of Benin are also actively involved in agricultural innovations and control priority setting in national agricultural systems.

International organizations such as CABI and the IITA have limited control of national research budgets except where they co-finance research projects, but their interventions are multidisciplinary and involve multi-institutional collaborations. However, many NARIs (especially most universities and national research institutes such as IIAM, INERA, INRAB, IIP, EIAR, SNV) and NGOs e.g. FARM Africa have average levels of involvement in innovations, but high to low power in the innovation process due to differences in their influence on national research budgets and priority setting. Many other local-level research institutes and commodity-based research centres (e.g., CNSF, IRSAT, TACRI, TORITA, TRIT, DRD, DRTE, CMB, CDT-Zambia, MINADER, UEM, CVRI and IDR) have limited involvement in innovations due to low budgetary allocations. The key lesson here is that institutions that have a clear focus on innovations and those that are supported by government departments that directly deal with agricultural innovations, have greater level of involvement in the agricultural innovation process, as is the case in Rwanda.

Along value chains, power dynamics are at work influencing markets and the value-added gain accruing to various actors. Power imbalances and information asymmetry have been faulted for low farmer integration in agricultural value chains. Value chain dealers (e.g. input suppliers and produce marketers) often take advantage of farmers' limited market information to sell inputs at exorbitant prices and offer minimal farm gate prices for their produce. This hampers the food security and poverty reduction potential of such value chains. Improving information flows, for example, using ICT-based innovations would help rectify market distortions. As represented by producer organizations in Benin, Rwanda and Tanzania (Table 2), the bargaining power of farmers could be improved by encouraging the formation of self-organized groups.

[20] Please see List of Abbreviations/Acronyms

Such farmer groups could provide inputs and credits to members, while also advocating for policy instruments to promote their collective interests within the chain. Depending on their level of development, the farmer groups could provide most functions in the chain including produce purchase, transportation, processing and marketing. Currently, no clear guidelines exist at the policy level on formation of farmer groups and this will be a good entry point under the TAP Policy Dialogue thrust.

Formation of innovation platforms as advocated by FARA's Integrated Agricultural Research for Development (IAR4D) approach is also one way of promoting interaction amongst value chain actors (indeed as microcosmic policy dialogue spaces) to even out power disparities and foster chain links. Knowledge co-creation with farmers and targeted capacity development for imparting negotiation skills are other means for empowering farmers to have their rightful niche in the value chains.

One area where TAP could engage is conducting a comprehensive analysis of power dynamics in innovation systems among the key innovation actors at macro-level (i.e. government ministries, research institutes, education institutes, funding agencies, and extension workers) and within specific commodity value chains that are key to food security in the TAP countries. This will help identify strategies for power redistribution and cultivation of ambidextrous capacity in innovation networks.

5.3 Selected Innovations and Innovation Projects in Africa

5.3.1 Research-Into Use (RIU)[21]

This is a DFID-funded project on Partnership for Agricultural Development (PIAD) or the National Innovation Coalition (NIC) that works to influence policymakers in Malawi, Rwanda, Zambia and Tanzania[22]. We use here the reports from Malawi to demonstrate the RIU has accomplished. In Malawi, the RIU programme helped to promote an innovation systems approach that facilitated the assembly of legume seed stakeholders in an Innovation Platform (IP) to identify bottlenecks and opportunities to increase seed availability by promoting farmer participation in multiplying breeder and basic seed for certified seed production. The NIC comprised of champions from various IPs and acts as a national platform for leveraging policy advocacy with government. Key stakeholders included CIAT, Department of Agriculture and Extension Services (DAES), Seed Trade Association of Malawi (STAM), Association for Smallholder Seed Multiplication (ASSMAG), Grain Legumes Association (GLA) representing farmer organizations, input suppliers and seed companies. The roles of these actors were CIAT – research, DAES (extension), STAM (seed production), and ASSMAG (adopters of the seed technologies). Interfacing with the various IP Champions, RIU Malawi Country Team played the brokerage role.

With USAID support, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), National Association of Smallholder Farmers (NASFAM), government service providers and FairTrade introduced improved groundnut production practices to reduce aflatoxin contamination, develop a system of grades and standards, and establish a traceability system to monitor aflatoxins during production in order to access high-value European markets. A special innovation in this respect is the introduction of a new detection kit, developed by the International Agriculture research Center for Semi-Arid Tropics (ICRISAT). The detection kit has enabled the farmers to cut the cost of testing crops from $25 to $1 per sample. This simple kit can even be used by the most remote rural farms to monitor grains and nuts and improve storage techniques to avoid contamination. As a result, Malawi groundnuts have started retailing in European supermarkets[23].

Still in Malawi, the Cotton Development Trust (CDT), comprising all cotton value chain actors, has made various achievements including:

- Acceptance and recognition of CDT by all stakeholders including the government

[21] See http://researchintouse.com/

[22] Hall, A. Dijkman, J. and Sulaiman V. R. (2010). Research Into Use: Investigating The Relationship Between Agricultural Research and Innovation. RIU Discussion Paper 01, 2010. DFID, UK.

[23] http://www.icrisat.org/impacts/impact-stories/icrisat-impacts-13.htm

- Contributing to review of the Cotton Act
- Initiation of a 5-year strategic plan to guide cotton development
- Support for establishment of the National Cotton Farmers Association of Malawi (COFAM)
- Advocacy for improvement of certified seed supplies
- Reduction in use of recycled seed
- Establishment of cotton test and demonstration plots linked to research undertaken by government's Makoka Research Station
- Establishment of a consultative platform for negotiation of seed cotton farm-gate prices
- Participation in a wider regional cotton development initiative

The CDT is an institutional development emanating directly from RIU Malawi's cotton platform. According to the RIU Malawi, Africa Country Programme Annual Report 2009 – 2010 (www.researchintouse.com), around 140,000 farmers have managed to increase cotton productivity from 800 to 2500 kg/ha and with the prevailing favourable world cotton prices, the farmers are laughing all the way to the bank. It may appear, at least from such success stories from Malawi pilot sites, that the RIU project has met some of its objectives of promoting the livelihood-enhancing potential of research. However, the scalability of RIU potential to the wider national innovations systems is yet to be proven and its reliance on development assistance does not guarantee sustainability beyond the program duration. Moreover, the degree to which the RIU program succeeded in integrating with or informing the national approach to agricultural innovations in the pilot countries is unclear.

5.3.2 Fee-for-service Extension Approaches

Various innovative agricultural extension models exist in some SSA countries. These models are based on a 'fee-for-service' extension that is provided by public or other agents and paid for by farmers/farmer groups. This arrangement allows clientele to 'vote' on programmes and programme scale by paying for them. It allows extension to be designed using farmer needs, priorities and feedback (Davis, 2008). With the exception of Burkina Faso that mainly uses the FFS approach, many of the other countries have multiple innovative extension models such as:

- Angola: FFS; Rural Development and Extension Programme
- Malawi: pluralistic, demand-driven, decentralised; one village one product; FFS
- Mozambique: Government-led pluralistic extension; FFS
- Rwanda: participative, pluralistic, specialised, bottom-up approach; FFS
- Tanzania: FFS; group-based approach; private extension; pluralistic; decentralised participatory district extension
- Zambia: participatory extension approach; FFS

In Ethiopia, a private firm – Target Business Consultants offers diverse consultancy services to different clients including government, donors, cooperatives and farmers. The services are fully paid for by the respective clients or donors working with the clients. Recently, Target conducted a major study on livestock marketing in Hamer *Woreda* area in southern Ethiopia where pastoralism is the main economic activity. The study, commissioned by an American NGO - Pact Ethiopia, provided useful policy suggestions on how to effectively commercialize pastoralism and make it a viable livelihood strategy through establishment of village markets, cooperatives, cereal banks and microfinance for the pastoralists (Wongtschowski et al., 2013).

5.3.3 Management Advice for Family Farms (MAFF)

Since 2001, MAFF approaches have been promoted in over 10 Francophone Africa countries, with the support of French Cooperation entities especially the French Development Agency (AFD). MAFF operates on five key principles:

a) Holistic approach that allows the producer and his/her family to analyze their situation, plan, make decisions, monitor their activities and evaluate results
b) Builds farmers' capacity
c) Based on learning methods

d) Integrates family farmers into networks
e) Provides support mechanisms for producers with a strong participation of farmer organizations and possible involvement of new actors e.g. NGOs

Under the MAFF approach, exchanges between producers are encouraged through various collective activities (training, group meetings to discuss results, field visits to share experiences, trials in farmers' plots to test innovations). Farmer organizations (FOs) play a special role in direct implementation of MAFF. For example, the management network in Burkina Faso and FUPRO in Benin. To enlarge the vision on training, MAFF actors participate in interesting initiatives for training advisors within the framework of public and private organizations at the national level that involves universities e.g. the University of Parakou and the University of Abomey-Calavi in Benin.

A study by CIRAD in Benin in 2012 showed that MAFF participants share with non-participants what they learn in MAFF sessions. Further, an assessment on possibilities of scaling up and scaling out of MAFF indicated that sustainability of the MAFF approach requires: a) widening the basic reach of advisory mechanisms by mobilizing FOs and farmer extension workers, b) multiplication of mechanisms for better coverage of the territory by asking the State to invest in overall governance of various advisory mechanisms, and c) better coordination of different advisory activities undertaken by various actors to promote synergies (Legile and Faure, 2013).

5.3.4 AGRA - Miruku 'Free Service Model' in Mozambique

This is a cooperative started in 2008 by 11 business and finance professionals. It is funded by AGRA on a three-year project and it provides business development services to 80 small and medium enterprises serving 14,000 smallholders. It helps enterprises to gain business planning and management skills, obtain credit, link them to suppliers and buyers, and improve their management and operations. *Miruku* helped *Muecate* (cooperative of 20 farmers' associations with 400 individual groundnuts and cashew producers) unite its members to get fair-trade certification. *Miruku's* input included organizational management and training, and the certification enables *Muecate* union members to get 15% more than what the traders pay in the market. However, its sustainability is not guaranteed due to donor dependence and absence of a clear exit strategy (Wongtschowski et al., 2013).

5.3.5 IMBARAGA's Subsidized Services Model in Rwanda

The Federation of Farmers and Breeders of Rwanda (IMBARAGA) is the umbrella farmers' federations in Rwanda providing training (especially on postharvest handling and storage), study tours, and market linkages to its members at subsidized costs. The services are partly financed by membership fees. The trainees may be representatives of the groups/cooperatives or individual farmer members. Postharvest training enables farmers to meet quality standards of major maize buyers e.g., the Ministry of Agriculture, RAB, and the Strategic Grain Reserve that pay more than other buyers. IMBARAGA also contracts local artisans to make simple equipment for sale to small-scale farmers. Its sustainability is strong and it has direct relevance to members' farming activities due to good management and targeting of it operations on smallholder needs (Wongtschowski et al., 2013).

5.3.6 Information and Communication Technologies in Extension

Use of modern forms of Information and Communication Technologies (ICTs) is also emerging as an important innovation in extension. For instance, the 'market spies' (*shu shu shu*) concept in Tanzania, whereby key informant farmers are recruited by farmer groups or ICT providers (such as MVIWATA) to regularly visit markets, collect real-time information on commodity prices and quantities, and update farmers in the village using mobile phones. This enables farmers to respond appropriately to demand and supply dynamics in the markets. The Rural Knowledge Network (RKN) also operates a market intelligence initiative in Tanzania. The RKN's specific achievements in Tanzania include provision of market information to facilitate cross border trade; and on-going efforts to establish sunflower pressing mill in Singida region, establish organic poultry farm in Dodoma, promote 'one product one district' concept to farming, and

enhance smallholder farmers' capacity to supply large quantities of sorghum to Tanzania Breweries Limited Company (FAO, 2011b).

5.3.7 Innovations based on IPs

There are also many innovation initiatives based on IPs. Some examples of such projects with IPs being used in SSA include (Anandajayasekerram, 2011):

- The GAT-led project on 'Enabling Rural Innovation' to improve the livelihoods of households through the creation of rural enterprises in Malawi, Mozambique and Rwanda.
- The FARA-led SSA Challenge Programme (SSA-CP) in Malawi, Mozambique and Rwanda.
- The NGO-led project Promoting Local Innovation (PROLINNOVA) in Burkina Faso, Ethiopia, Mozambique, Niger and Tanzania.
- The CIMMYT-led project on Sustainable Intensification of Maize-Legume Cropping Systems for food security in Eastern and Southern Africa (SIMLESA) in Malawi, Mozambique, Ethiopia and Tanzania.
- The AURDC-led project on Vegetable breeding and seed systems for poverty reduction in Tanzania.
- Innovation Platforms for Technology Adoption (IPTAs) to disseminate agricultural technologies under FARA's Dissemination of New Agricultural Technologies in Africa (DONATA) program

The commodity-based Mozambique IP at Changara is considered as a success story and is often used by local government officials as one of the major entry points for government-led interventions in the livestock community. The IP has provided space for constructive debate and problem solving in livestock value chains. Ethiopia has various institutions that engage in seed multiplication and distribution of improved genetics to enhance productivity. They include Ethiopian Seed Enterprise (ESE), Regional Seed Enterprises (RSEs), National Artificial Insemination Centre and Pioneer Hybrid Company (Federal Democratic Republic of Ethiopia, 2010).

5.3.8 Index Insurance – 'Kilimo Salama'

In late 2012, the government of Rwanda, in collaboration with Syngenta Foundation for Sustainable Agriculture introduced an indexed insurance programme for farmers, backed up by satellite weather stations to monitor the precise impacts of drought and heavy rains on farming. The initiative known as 'Kilimo Salama' ('safe insurance'), uses satellite stations to monitor how rainfall variability and drought affect crop production. The stations measure rainfall, temperature, wind speed and sunlight. The data are used to determine whether a specific plot of land has been negatively affected by drought or heavy rainfall. Under the scheme, the Rwandan government distributes seed bought from local producers and importers on credit, through its Crop Intensification Programme. The programme also distributes chemical fertilizers to participants and emphasizes training in various farming methods. The insurance itself is provided by local insurance firms, while reinsurance for their risks is guaranteed by Swiss-Re, a global re-insurer. About 12,000 farmers have been insured since the scheme began. Due to heavy rains and drought in the country's South and Western provinces between May and September 2012, payments totalling $10,000 have been made to some 1,600 farmers. Suffice it to note here that the 'Kilimo Salama' initiative also operates in other ASARECA countries such as Kenya, where it was introduced much earlier than in Rwanda.

Even though each of the innovations and innovation projects outlined above address specific and pertinent problems of the target groups, their sustainability hinges on how, by whom, and for what they were initially introduced. The innovations that obtained sufficient local buy-in in the introductory stages like the Mozambican Changara IPs have greater likelihood of sustainability beyond the project end date. Others that require heavy capital outlay mainly sourced from foreign donors (e.g. the index insurance) may work only as long as the aid funds are forthcoming. As the innovations address divergent issues, it may be impractical to draw sweeping global conclusions. However, some of the innovations display similarities in their approach. For example, the MAFFs is seemingly a special form of FFS applied to extension, while both Miruku and IMBARAGA cases hinge on an organizing principle for collective bargaining and furtherance of group interests. A facility like the TAP that seeks to minimize duplications obviously will come in handy (perhaps under the Marketplace) in brokering information and experiences to avoid 're-inventing the wheel.'

5.4 Networking and Public-Private Partnerships for Innovations

Networking and partnerships among stakeholders (especially, private companies, producer organizations, extension workers and research organizations) are more prominent in the ASARECA countries (Rwanda, Tanzania, and Ethiopia) through regional initiatives. Zambia and Benin also have strong partnerships between CGIAR centres and their NARIs. In addition, Zambia together with Rwanda and Tanzania appear to be more active in facilitating stakeholder interactions mainly through regular stakeholder round table discussions and seminars often facilitated by government line ministries. However, partnerships with private sector are either weak or missing in some countries. Many countries also lack mechanisms to acquire low-cost technologies from other countries due to inadequate international collaboration.

Under the New Vision for Agriculture unveiled by the World Economic Forum in 2013, partnerships follow four key steps[24]: first, align stakeholders around a shared vision at national level, business, donors, civil society and farmers; second, agree on a set of priorities for intensive farms considering geographic features, value chain commodities and enabling environment issues; third, develop plans and initiate action on agreed priorities; finally, monitor progress and assess learning.

Some noted regional innovation partnerships include:

5.4.1 Platform for African European Partnership on Agricultural Research for Development

The Platform for African European Partnership on Agricultural Research for Development (PAEPARD) was initiated in 2008 with funds from the European Union through its Food Security Thematic Programme to support research collaboration between organizations in Africa and Europe. Phase I of PAEPARD focused exclusively on partnerships between African and European research institutes. Subsequently, incorporation of systems thinking in stakeholder partnership building heralded Phase II of PAEPARD in 2009 with the following objectives:

- Facilitate holistic partnerships between farmer organizations, civil society groups, research institutes and education institutes, private companies and policy networks.
- Support these partnerships through capacity strengthening and enabling access to information on funding opportunities.
- Help partners to prepare bankable research proposals addressing real needs at the end-user level.
- Advocate for increased support for demand-led, multi-actor agricultural research (e.g. through innovation platforms).

PAEPARD is jointly coordinated by FARA and AGRINATURA, a consortium of research and education organizations in Europe. Other partners include Pan-Africa Farmers Organization (PAFO) and its sub-regional networks, Collectif Stratégies Alimentaires (CSA), the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), Comité de liaison Europe-Afrique-Caraïbes-Pacifique (COLEACP), Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN), the International Centre for development-oriented Research in Agriculture (ICRA), African sub-regional organizations, Technical Centre for Agricultural and Rural Cooperation (CTA), and others.

PAEPARD aims at strengthening the capacities of non-research stakeholders to lead and compete for grants supporting agricultural research for development. It also aims at promoting equitable, balanced, demand-driven and mutually beneficial collaboration of Africa and Europe on ARD to attain the MDGs. The Platform focuses on inclusive partnerships with non-research stakeholders such as civil society and private sector organizations in Europe and Africa. To date, 19 consortia comprising researchers and non-researchers have

[24] World Economic Forum (2013). Achieving the New Vision for Agriculture: New Models for Action. A report by the World Economic Forum's New Vision for Agriculture initiative. http://www3.weforum.org/docs/IP/2013/NVA/WEF_IP_NVA_New_Models_for_Action_report.pdf. Accessed 4 August 2013.

been formed across the continent under PAEPARD. Using Users Led Process (ULP), platforms led by farmers' organizations and private sector jointly develop bankable proposals based on their needs defined through internal consultations. PAEPARD has trained more than 40 Agricultural Innovation Facilitators (AIFs) to facilitate innovation partnerships between researchers and non-researchers.

PAEPARD is currently facilitating multi-stakeholder innovation partnerships based on ULP with the following stakeholders:

- East African Farmers' Federation (EAFF): Extensive Livestock value chains in Eastern Africa with Specific focus on Kenya and Uganda; with focus on only one value chain: Beef production;
- [4] AfDB – Africa Development Bank
- Plateforme Sous-Régionale des Organisations Paysannes d'Afrique Centrale (PROPAC): Urban horticulture value chain in Central Africa (Cameroon, Congo Brazzaville & DR Congo);
- Réseau des Organisations Paysannes et de Producteurs de l'Afrique de l'Ouest (ROPPA): Rice value chain in Benin, Burkina Faso & Mali;
- Southern African Confederation of Agricultural Unions (SACAU): Groundnut value chain in Malawi & Zambia;
- Europe-Africa-Caribbean-Pacific Liaison Committee (COLEACP): Adding value to Mango non-food uses in West Africa (Burkina-Faso, Cote d'Ivoire, Senegal)

5.4.2 Grow Africa Partnership

Grow Africa is a regional partnership jointly convened by the AUC/NEPAD and the World Economic Forum to mobilize investments and partnership in alignment with the NAFSIPs of post-Compact African countries. The Grow Africa initiative was formed in 2011 to facilitate more private sector investment and financing for African agriculture towards achievement of CAADP pillars objectives. Participation in the Grow Africa partnership is open to all African countries that are able to demonstrate their readiness to attract investments aligned to their national strategy for agricultural transformation. For effective operation, the number of participating countries is initially limited to a maximum of 10. The countries must have:

a) a clear national strategy with priorities agreed through an inclusive process (generally a CAADP investment plan that has passed a technical review)
b) strong and committed leadership at Ministerial or Presidential level
c) a partnership platform through which to facilitate collaborative, action-oriented public, private and civil society dialogue
d) an implementing unit with a mandate and capacity to promote investment and partnerships.

During the initial period of 2011-2012, Grow Africa supported Burkina Faso, Ethiopia, Mozambique, Rwanda and Tanzania. The partnership is anchored on government plans and it engages private sector, farmers' organizations, donors, civil society organizations, public sector institutions and other stakeholders. The private sector has channelled USD$3 billion through a special initiative linked to the G8 with focus on supporting smallholder farmers in the next 3-5 years.

The Grow Africa partnership was successfully piloted in Tanzania before being up-scaled to the other African countries. It is based on the following principles: country-led, market-based, multi-stakeholder approach, smallholder farmer-focused and transparency, i.e., public sharing of information and reporting. Under the Grow Africa initiative, various private companies are committed to supporting agribusiness and innovations in different ways. The main successful PPPs fostered by Grow Africa so far include:

Tanzania

The Southern Agricultural Growth Corridor of Tanzania (SAGCOT) is a showcase initiative of PPPs in agricultural growth. SAGCOT was initiated through Tanzania's national sector plan for agriculture and the President's '*Kilimo Kwanza*' ('agriculture first') resolution, indicating high political commitment. It rallies global and local companies in specific projects and engages development partners to align resources and co-invest in the high-potential corridor. It also facilitated dialogue on enabling environment issues including seed policy and infrastructure development. The Government has demonstrated its commitment to build private sector confidence by ensuring certainty and transparency in trade and land tenure policy. For

instance, the pre-profit tax at farm gate is to be reduced or lifted all together. In addition, village land boundaries in Kilombero District have been demarcated to accelerate land-use planning, surveying and secure titling for smallholders and investors.

A private international company, *Armajaro* formed a partnership between its subsidiary in Tanzania and Kenya-based Coffee Management Services to assist coffee farmers through training on good agricultural practices. *Armajaro* has a 5-year plan to forge direct relationships with over 400,000 smallholder farmers in 10 countries. The company aims at sustainable production programme through creation of *farmer development centres* as an innovative means of delivering farmer-level technical assistance including training, inputs on credit, improved planting material and measures to improve yields and livelihoods of cocoa and coffee farmers. By facilitating a stronger negotiating position, access to favourable new markets and improved farm management, farmers are better equipped to control operational costs, productivity and product quality, thereby enabling improvement of profit margins.

The Grow Africa initiative has also facilitated the expansion of a local milk processing company, *Shambani Graduates Enterprises Limited* that was founded in 2003, from rented processing facilities to own land, capacity to develop business plan and equity financing. Another important partnership is the world's largest fertilizer distributor, *Yara International*'s efforts to complement its $20 million investment in a port fertilizer terminal at Dar es Salaam by working with national and international partners, fertilizer distribution and agro-dealer network in Tanzania. *Yara* has multilevel efforts geared towards facilitating sustainable and commercially viable agribusiness models that include smallholder farmers. At the international level, *Yara* provides leadership in public-private dialogue on transformative agri-partnerships. At the pan-African level, it engages in proactive business development efforts to identify the most competitive location for world-class fertilizer production facility at an estimated investment of $2 billion. At the national level, *Yara* has developed country engagement strategies and action plans (involving both agro-dealers and smallholder farmers) to fast track investment commitments.

Ethiopia

In less than two years since its formation, Ethiopian Agricultural Transformation Agency (ATA) has emerged as a strong model for facilitating delivery of agricultural transformation. It has 150 high calibre staff dealing with 14 topical issues across over 60 initiatives. The ATA partnership with the Ethiopian Ministry of Agriculture and regional agricultural bureaus has introduced new planting technologies and practices for *teff*, a staple grain to cover over 75,000 smallholder farmers in the first year. The outreach approach entails 1,500 farmer-training centres in four major *teff* growing regions in Ethiopia. This initiative has almost doubled teff productivity for participating farmers. Buoyed by this success, the ATA and its partners now plan to up scale the effort to reach 1 million smallholder farmers in the second year and double the national *teff* production in 5 years. The ATA also facilitated linkages between the multinational brewer, *Diageo* Company Limited, global and local private sector companies, farmers' cooperatives and civil society organizations to launch a pilot programme to improve barley productivity for at least 6,000 farmers in the next 3 years. Through its commitment to increase its local sourcing of agricultural raw materials in Africa from 50% to 70%, *Diageo* expects to source about $500,000 worth of barley from nearly 1,000 smallholder farmers in Ethiopia in the first pilot season. The ATA also assists in piloting new ideas and de-bottlenecking issues for investors and ministries by building coordinating capacity for investors. Furthermore, the ATA is in dialogue with *Yara* International Company to engage more deeply with Ethiopia's agri-development efforts. *Yara* is also advancing dialogue to develop a business partnership in Burkina Faso targeting rice value chain under the *Bagre*' Growth Pole initiative.

Rwanda

Within the Grow Africa initiative, the Government of Rwanda gives high priority to private sector investments in agriculture. For example, the Ministry of Agriculture and Animal Resources (MINAGRI) partnered with the agribusiness arm of the Rwanda Development Bank (RDB) to commission an overview of investment opportunities in high value agriculture e.g., coffee, tea, fertilizer distribution, horticulture processing, essential oils, potatoes, avocado and beans. The commissioned survey showed that up to 18,000 hectares of land could be available for tea production and that Rwanda has a potential fertilizer

demand of 48,000 metric tonnes by 2017. A multi-stakeholder working group was subsequently formed to market these opportunities to investors and facilitate investments. The MINAGRI and RDB are preparing a 'roadmap' to identify specific measures to activate necessary investments and to build requisite capacity for investment promotion.

Mozambique

Under the Grow Africa partnership, the Mozambican Government, local and international agribusinesses launched the Beira Agricultural Growth Corridor (BAGC) with support from the UK, Norwegian and Dutch Governments. A unique component of this PPP arrangement is the $20 million catalytic fund managed by AgDevco Limited. Investments made by the fund have catalyzed private sector investment in livestock, maize, bananas, avocados, potatoes, mangoes, sesame, soya, sunflower and honey. The key lesson from this arrangement is that profitable and sustainable agricultural growth requires availability of catalytic capital, focus on developing profitable clusters of firms in areas with reasonable infrastructure, and renewed investor interest in agriculture.

5.4.3 Agricultural Innovation MKTPlace[25]

The Agricultural Innovation MKTPlace is an international initiative supported by different donors to foster innovations benefiting smallholder producers through collaborative partnerships between African, Brazilian, and Latin America & Carribean (LAC) experts and institutions. The Innovation MKTPlace comprises three basic pillars:

- A policy dialogue between the main authorities from Africa, LAC and Brazil supporting institutions focused on the development of a mutually agreed framework for collaboration
- A forum for presentation and discussion of research for development ideas, including proposal selection that would be competitively supported
- Support and implementation of joint agricultural research for development projects

Initial engagement on this initiative was at the 13th African Union Summit held in Sirte, Libya, in 2009, where the Brazilian Government proposed holding a "Dialogue Brazil-Africa on Food Security, Fighting Hunger and Rural Development" in Brazil. Subsequently, the Dialogue was held at Embrapa, Brasilia, in 2010. A key outcome of this meeting was the formation of the "Africa-Brazil Agricultural Innovation Marketplace", which was officially launched at the Fifth Africa Agriculture Science Week and the Forum for Agricultural Research in Africa (FARA) General Assembly in Ouagadougou, Burkina Faso, later in the year.

By early 2011, six projects had been approved for funding by the Marketplace. These included projects submitted by applicants from Mozambique and Burkina Faso. Additional two projects from Ethiopia were later approved. The Marketplace has so far funded over 10 projects submitted by stakeholders from seven African countries in various thematic areas ranging from biofuel technologies, apiculture, dairy husbandry, conservation agriculture, natural products research, and other commodity-specific technologies. The Mktplace methodology/process has promoted interactions among public and private institutions and high level of commitment and motivation among partners. Main benefits cited by African partners include access to genetic materials; capacity building; opportunities to partnerships between research institutions; sharing technologies; sharing research focused on practical results using local capacity; equipment and structural improvements in the laboratories[26]. By its approach, the Agricultural Innovation MKTPlace would seem a plausible template for TAP.

5.4.4 African Fertiliser Agribusiness Partnership

African Fertiliser Agribusiness Partnership (AFAP) is a collaborative programme among the Alliance for Green Revolution in Africa (AGRA), African Development Bank (ADB), International Fertiliser Development Center (IFDC), Agricultural Market Development Trust- Africa (Agmark), NEPAD and other specialised agencies, with the support of the African Union Commission. AFAP works with the public and private

[25] http://www.africa-brazil.org/site/index.php/what-we-do/about-the-marketplace

[26] Agricultural Innovation MKTplace (2013). Progress Report, January 2011 – October 2012. Africa–Brazil–Latin America and Caribbean Agricultural Innovation Marketplace.

sectors to invest in fertilizer markets so that African smallholder farmers can grow food and profits. The main objectives of the program are to: a) make fertilizer accessible and affordable for African smallholder farmers; b) bolster capacity of farmers and incentive for fertilizer use; and 3) foster responsible fertilizer use to increase crop yields and decrease food insecurity. The principal operating mechanism of AFAP will be Agribusiness Partnership Contracts (APCs) to implement significant market development activities with local farmers and/or agribusiness. AFAP joins industry and development interests to inspire productivity, food security and prosperity in Africa. It has two main goals for the countries in which it works: increase the number of fertilizer users by 15 percent and at least double total fertilizer use. For the TAP target countries, AFAP is currently active in Ethiopia, Malawi, Mozambique and Tanzania. Launched only in 2012, the impacts of AFAP are still not documented.

5.4.5 AGORA Partnership

In Burkina Faso, a partnership between the FAO, Access to Global Online Research in Agriculture (AGORA) programme, Microsoft Technology Company and INERA has worked to develop a new micro-dose fertilization technology, adapt it to local needs and disseminate it to farmers. The micro-dose fertilizer technique is based on the application of small quantities of fertilizers placed close to each seed at planting, thereby enhancing fertilizer efficiency and improving yields while minimizing input cost. In order to enable farmers to access the micro-dose technology, farmer-based cooperatives have been established and village savings micro-credit associations formed. With the assistance of the FAO, the warrantage inventory credit system[27] enables farmers to obtain loans through their cooperatives to purchase fertilizer if they use common storage facilities for their harvested crops. They repay the loans once the crops are harvested and sold, which provides greater stability for local grain markets during harvest time to avoid a glut or shortage of crops (FAO and AGORA, 2012).

5.4.6 CGIAR Centres and NARIs

All centres under the CGIAR system (including ILRI, IITA, IRRI, CIP, ICRISAT, CIMMYT, IFPRI and the International Water Management Institute – IWMI) have effective cross-country and inter-regional research collaborations in Africa. Such partnerships also involve participation by other international agencies. For instance in Rwanda, a partnership between CIAT and *Institut des sciences agronomique du* Rwanda (ISAR) developed over 20 improved varieties of climbing beans through support from the Swiss Development Cooperation (SDC), CIDA, Rockefeller Foundation and BMGF. Musoni et al. (2005)[28] report that the improved varieties of climbing beans have a yield advantage of 150% to 300% and better disease resistance over the conventional ones. The reported adoption rates were over 50% among farmers just 10 years after their introduction, are they are fast replacing the bush type, raising on-farm productivity and contributing significantly to the GDP in Rwanda. ISAR has since been transformed into the Rwanda Agricultural Board (RAB) by merging with the national extension agencies. FARA also supports innovation in Rwanda through formation of IPs and training of farmers on commercial seed production. The IPs comprise farmers, finance organizations, input suppliers, research and extension staff, and private sector involved in seed multiplication and marketing of beans. The IP members consult on identifying opportunities for value chain improvement (Adekunle et al., 2012).

On average, the CGIAR system allocates 40 – 50% of its global research budget to SSA. By late 1990s, about 20% of the region's crop area was planted with improved varieties developed by CGIAR centres. In addition, one of the main documented impacts of CGIAR research in SSA is control of cassava pests in smallholder farms using biological control agents that it developed and disseminated (Fugile and Rada, 2011). According to Maredia and Raitzer (2006)[29], impacts of research on biological control of several pests that threaten the

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[27] Tabo, R., Bationo, A., Amadou, B., Marchal, D., Lompo, F., Gandah, M., Hassane, O., Diallo, M.K., Ndjeunga, J., Fatondji, D., Gerard, B., Sogodogo, D., Taonda, J.B.S., Sako, K., Boubacar, S., Abdou, A. and Koala, S. 2011. Fertilizer microdosing and "warrantage" or inventory credit system to improve food security and farmers' income in West Africa. Pages 113-121. In: Innovations as Key to the Green Revolution in Africa: Exploring the Scientific Facts. Proceedings of the International Symposium of the African Network for Soil Biology and Fertility (AFNET) of TSBF Institute of CIAT, September 17-21, 2007, Arusha (Bationo, A., Waswa, B., Okeyo, M.J., Maina, F., Kihara, J., eds.) Vol 1. 866 pp. ISBN 978-90-481-2541-8

[28] Musoni, A., Buruchara, R., and Kimani, P. M. (2005). Climbing Beans In Rwanda: Development, Impact, And Challenges. In Proceedings of PABRA Millennium Workshop, held at the Novotel Mount Meru, Arusha, Tanzania, 28 May – 1 June 2001

[29] Maredia, M. K. and Raitzer, D. A. (2006). CGIAR and NARS partner research in sub-Saharan Africa: evidence of impact to date. CGIAR Science Council. http://impact.cgiar.org/pdf/100.pdf. Accessed 5 August 2013.

production of major commodities in SSA contribute more than 80% of the total estimated benefits of the CGIAR research investments in this region. These benefits stem predominantly from the IITA-led collaborative projects on biological control of the cassava mealybug using *Apoanagyrus lopezi*. By 2006, the total documented benefits from the introduction of *Apoanagyrus lopezi* to control the cassava mealybug in SSA are estimated at US$13.9 billion. The figure derives from the value of crop losses averted on about 9 million ha of cassava harvested in SSA (Maredia and Raitzer, 2006).

5.4.7 The Africa Science Agenda

The Africa Science Agenda is an emerging initiative of CAADP, the CGIAR and CAADP's Development Partners to deepen the alignment and improve collaboration between Africa's agricultural research, extension and education programmes and the programmes of the CGIAR Consortium and other important partners, to facilitate agricultural transformation across the African continent. Thus, the Africa Science Agenda seeks to deepen the age-long CGIAR-NARS partnership in agricultural innovations. The framework embodies the following thematic areas: research and technology generation; education and training; knowledge and communication; institutional development; and policy and advocacy.

The Science Agenda will facilitate the refreshing of a common vision for all actors engaged in agricultural science and technology (S&T) and serve as the principal reference of the demand for S&T on the continent and therefore as the primary guide for its planning at all levels. It will also facilitate partnership around the vision and the evolution of a platform for collaboration among S&T actors within the continent and with their external counterparts. Of particular focus, the Science Agenda will integrate the National Agricultural Food Security Investment Plans (NAFSIPs) developed by African countries under the CAADP country roundtable processes with the CGIAR Research Programmes (CRPs). Currently, FARA is leading the development of a strategy for the Science Agenda.

5.4.8 Coherence in Information for Agricultural Research for Development (CIARD)

In Africa, FARA is the founding partner of the movement for Coherence in Information for Agricultural Research for Development (CIARD). CIARD seeks "to collaboratively develop common standards, share knowledge, and contribute to effective and coherent institutional approaches in agricultural science and technology information." This is mainly by supporting open access to agricultural information and knowledge across the continent that will empower all actors, especially farmers. The global movement was established in 2008 with the specific aim of enhancing access to data and information in the public domain to improve development based on agricultural research results (see www.ciard.net). A more coordinated approach in enabling and supporting accessibility of data and information in the public domain globally would relieve many smaller organisations of the need to develop and operate their own systems.

CIARD has three priority areas: 1) make content accessible by promoting open content, open systems and common international standards; 2) develop capacities to ensure empowered individuals with awareness and skills and self-sufficient institutions with ownership; and 3) advocate better investments through sound policies that enable easier access to information, coordinated approaches, and evidence of benefits. Examples of African organizations in targeted countries who have subscribed to CIARD include Haramaya University in Ethiopia.

5.4.9 TEAM-Africa and the Tertiary Agricultural Education Partnership

The Tertiary Education for Agriculture Mechanism in Africa (TEAM-Africa) is an initiative jointly spearheaded by African tertiary agricultural education (TAE) partners FARA, NEPAD Planning and Coordinating Agency (NPCA), RUFORUM and ANAFE. It origins goes back several years, although it was officially inaugurated in 2012. TEAM-Africa seeks to broker networks, alliances, and consortia to bring high-leverage economies of scale to transforming TAE in Africa to meet the CAADP goals in a way that dramatically reduces poverty. Accordingly, TEAM-Africa´s objectives are as follows:

- To help facilitate and guide the transformation of African tertiary institutions, in line with the FAAP principles and within the framework of CAADP;

- To raise the profile of TAE and enhance its value-contribution to economic development;
- To increase the overall level of financial and technical support to TAE in Africa; and
- To bring greater coherence to investments for TAE in Africa

The 'TAE Partnership' was launched in 2011 to mobilize broad support for TEAM-Africa in its efforts to raise the profile of investment in TAE transformation and to coordinate and articulate ways to foster collaboration and harmonization of TAE initiatives in Africa. It comprises academic experts, Development Partners (DPs) and African TAE-leaders. The scope of this partnership was later expanded in 2012 to bring on board an ever-wider group of academic institutions, networks and DPs from Europe, the US and Africa. The TAE Partnership is a consultative forum for development partners and African stakeholders to:

- Articulate the importance of TAE transformation to development;
- Share experiences and discuss lessons learned from past and current programs of support to TAE in Africa;
- Better understand the TEAM-Africa concept and Africa's plans for reforming TAE and how best to support them; and
- Establish a joint work program outlining concrete actions for the TAE Partnership to increase coordination and alignment of DPs´ support for TAE in Africa.

The TAE-Partnership meetings and workshops have provided the opportunity to begin to better collaborate, start joint mapping and analysis exercises, and start implementing more coordinated initiatives for TAE in some initial countries including Tanzania, and Benin. The TAE-Partnership continues to raise awareness on TAE and TEAM-Africa, work together to support the integration of the defined principles and promote greater collaboration within existing and future activities.

5.4.10 The UniBRAIN Initiative

The Universities, Business and Research in Agricultural INnovation (UniBRAIN) is an initiative of the Forum for Agricultural Research in Africa funded by Danida and currently under implementation in five Danida-priority countries of sub-Sahara Africa including Zambia. One of the strategic areas identified by the African Commission for focus toward improving Africa's growth, employment, and competitiveness is promoting post-primary education and research through linking university education, research and private sector development in sustainable agriculture and agribusiness. The UniBRAIN Initiative is a direct response to this strategic area. UniBRAIN seeks to bring universities into the African agricultural innovation system through facilitated sustainable linkages amongst the key actors: university research and teaching, agricultural research and agri-business. This will be achieved by building innovation cultures through innovation incubation initiatives, targeted training and cross-cutting facilitative activities. The main African partners in this initiative are FARA, ANAFE, PanAAC, ABI-ICRISAT, ASARECA, CORAF/WECARD, and CCARDESA. In addition, there are several consortia partners in the target countries principally involving a university, a research organization, and agribusiness facility and other private sector agencies.

The UniBRAIN approach is to establish agribusiness innovation incubators that will support agribusinesses across agricultural value chains at all stages of development from start-ups that need handholding to established to firms that want to expand, diversify, enter new markets or solve Roles and Responsibilities of the UniBRAIN Partner Institutions problems. The initiative was launched in 2011 and has since funded five agribusiness incubators in Kenya, Uganda, Ghana, Mali and Zambia.

5.4.11 DONATA & RAILS Platforms

With support from the African Development Bank (AfDB), FARA initiated the Promotion of Science and Technology for Agricultural Development in Africa (PSTAD) project. The PSTAD project supports implementation of two African-wide initiatives, viz.: Regional Agricultural Information and Learning Systems (RAILS) and Dissemination of New Agricultural Technologies in Africa (DONATA). These two initiatives aim at improving knowledge management and enhance the adoption and use of proven technologies or innovations by the various stakeholders in Africa's agriculture, much in tandem with DfID's RIU approach. The project is being implemented in 34 low-income African countries that are eligible beneficiaries. DONATA seeks to strengthen the innovation capacity of stakeholders for more effective, efficient, rapid and

large-scale dissemination and adoption of successful agricultural best bets. It does this through the establishment of Innovation Platforms for Technology Adoption (IPTAs) to facilitate interactions between policy makers, advisory service agencies, researchers, farmers and rural communities, and agro-processors and agribusiness. The main objectives of DONATA are to:

- Identify the most profitable and environmentally beneficial African model crops, best bets, and other agricultural enterprises for scaling-up and out in areas where they are suited but where they are currently not accessed and utilised
- Analyse challenges and opportunities in value chain approach in scaling-up and out, agricultural best bets and disseminating success stories
- Develop toolkit(s) for disseminators that facilitates the targeting of best bets to where they fit the prevailing social, environmental and market conditions.

On the other hand, the objectives of RAILS are to:

- Advocate for increased investments in agricultural information systems by the African governments and institutions.
- Improve the access and contribution by African ARD Stakeholders in the global knowledge sharing
- Facilitate agricultural information systems synergies and value addition between international and national research for development institutions
- Consolidate national, sub-regional and continental ARD information systems to create an African platform for AIS that could contribute to the global AIS

Ultimately, RAILS seeks to achieve:

- Increased participation of African ARD stakeholders in global knowledge
- Increased exchange of information and learning among NARS, SROs and international partners
- Awareness by African governments of ARD contribution to African economic growth
- Accelerated dissemination and uptake of Agricultural research products and farmer innovations contributing to achievement of the African Vision and the MDGs

DONATA has initiated value-chain IPTAs in several countries including Mali (maize), Democratic Republic of the Congo (DRC), Kenya (orange-fleshed sweet potatoes, OFSP), Burkina Faso (maize), Mozambique (maize), Tanzania (quality protein maize), and Zambia (sorghum)[30]. In Mali, for example, the maize yield has reportedly increased from 1.5 – 1.8 tons/ha to 3.5 – 4 tons/ha. The yield increase is attributed to availability and use of certified seeds in the IPTA rather than farm-saved grains.

5.4.12 AGRA's Breadbaskets

In Tanzania, the Alliance for Green Revolution in Africa (AGRA), in collaboration with the United Republic of Tanzania and other development partners are initiated a Breadbasket strategy in 2010 to trigger a green revolution in the Southern Highlands of Tanzania. The strategy aims to improve food security, smallholder farmers' income and regional competitiveness by investing in the seed value chain. The key measures adopted include developing high yielding locally adapted crop varieties, multiplying the seeds and making them easily accessible to smallholder farmers through rural based agro-dealers. Other areas of focus include developing integrated soil fertility management technologies and improving farmers' participation in warehouse receipt system (WRS) to reduce post-harvest losses and stabilize prices. Concrete impact studies have not been undertaken for the project, but field reports indicate appreciable yield increases in the pilot areas.

5.4.13 Other Partnerships

Other forms of collaborations exist between different stakeholders in various countries. For example, in Ethiopia universities, government extension staff and agricultural research centres such as Debre Zeit, Melkassa and Adami Tuha serve in Research Extension Advisory Councils (REACs). The REACs were instituted by a new strategic orientation by the government way back in 1999 to strengthen the loose

[30] FARA (2012). Making things happen Stories of how DONATA's innovation platforms are strengthening farming communities across Africa. Forum for Agricultural Research in Africa (FARA), Accra, Ghana.

linkage between research and extension way back in 1999. In addition, the strategy aimed at bringing together all stakeholders in the entire knowledge spectrum of technology generation, transfer, and utilization under the umbrella of one institutional setup[31]. The NGOs also collaborate with public extension agencies through the government's agriculture and livelihood programme. The Catholic Relief Services (CRS) in collaboration with Meki woreda in Oromiya region promotes community-based maize seed multiplication of the Melkassa-1 variety in Meki and Zeway areas. This collaboration also promotes the bargaining power of farmers through establishment of local cereal banks. In addition, there is strong collaboration between FOs and government extension e.g., Oromiya Farmers' Cooperative Union and government extension in coffee agronomy, marketing etc. Input supply companies such as Pioneer Hybrid Seeds Company seeks approval from National Variety Release Committee (NVRC) to produce, process, pack and market seeds (Tesfaye, 2008). *Sidam* Coffee Farmers Cooperative Union (SCFCU) also promoted production of over 35,000 tonnes of *Sidam* coffee by about 87,000 farmers (Tesfaye, 2008).

Mozambican agricultural organizations are open to collaboration with external partners. The Directorate of Training, Documentation, and Technology Transfer of the Agricultural Research Institute of Mozambique is charged with coordinating collaborative ventures, knowledge flows and technology transfer. This is demonstrated by their recent collaboration with Michigan State University to define conservation agriculture priorities in Mozambique (Grabowski et al., 2013[32]). Under the New Alliance for Food Security and Nutrition, the G8 countries announced in April, 2013, that they plan to invest USD$380 in Mozambican agriculture. In this initiative, the main external partners will be the USA, Japan and the Australian Centre for International Agricultural Research (ACIAR).

Another important partnership in Mozambique unveiled in 2011 is the ProSAVANA initiative. This is Brazil's current flagship programme in Mozambique and it aims to transform the country's savannah land along the Nacala corridor. The project will draw on Brazil's experience in the Cerrado of Brazil. It reflects a useful example of a Triangular G20 partnership since it involves China and UK through DFID. However, ProSAVANA has been faulted by the local peasant associations on the following issues:

- Introduction of the project has been top-down with little engagement of the affected communities
- The programme will likely lead to landlessness due to land expropriation and resettlement
- The impoverishment of rural communities due to destruction of livelihood support systems
- Environmental hazards due to soil degradation and pollution of water resources with chemical pesticides and fertilizers
- Ecological imbalances due to vast deforestation

These issues put to test the purported success of triangular cooperation projects. Like in the other parts of Africa, it appears that the multinationals in ProSAVANA have colluded with top government officials to deprive locals of their only source of livelihood – land. However, the concepts of growth corridors and breadbaskets - special locations earmarked for concerted deployment of specific agricultural investments - appeals to the imminent performance demanded of African agriculture, provided the interventions are pro-poor and support smallholder agriculture. Indeed, AGRA has leveraged on this premise in their efforts toward an African Green Revolution. Since TAP focuses on smallholder agriculture, the specific case of ProSAVANA partnership would appear to be a counter innovation, while the Agricultural Innovation MKTPlace would serve as a good template for the TAP agenda.

5.5 Funding of Research and Innovations

The key providers of research grants include international organizations such as the International Fund for Agricultural Development (IFAD), the European Union (EU), World Bank, SIDA, Canadian International

[31] Kassa, B. (undated). Agricultural Research and Extension Linkages In Ethiopia: A Historical Survey. http://www.oerafrica.org/ftpfolder/website%20materials/Agriculture/haramaya/Perspective_Agricultural_Extension/AICM%20Module%20Final%20Jan%2031,%202012/Paper_on_research_extension_likage21_Share.doc. Accessed on 5 August 2013.

[32] Grabowski, P., F. Walker, S. Haggblade, R. Maria, and N. Eash (2013).Conservation Agriculture in Mozambique – Literature Review and Research Gaps.IIAM Working Papers Series, Mozambique.

Development Agency (CIDA) and individual donor countries including Britain, Japan and Ireland. Very few African governments contribute funds towards agricultural research grants. Moreover, only four of the reviewed countries had achieved the CAADP target of at least 10% allocation of the total national public expenditure to agriculture (these are Burkina Faso, Ethiopia, Malawi and Niger). Across the countries reviewed, the share of GDP invested in agricultural R&D is much lower (between 0.25% and 0.5% in Niger, Ethiopia, and Tanzania) compared to 1.43% in Kenya. In Zambia more than half (57.2%) of the public expenditure in agriculture is allocated to the Food Reserve Agency, 28% goes to the Farm Input Subsidy Programme (FISP), 0.7% is for other poverty reduction programmes while 14.2% is for other expenditures.

However, the CAADP benchmark has helped to focus the debate and the aspirations of the stakeholders. One of the issues related to public spending on agriculture in African countries is that most of the allocated public funds to the sector are spent on recurrent commitments such as staff salaries and maintenance, leaving little if any for new research initiatives. Therefore, irrespective of whether the countries had met this continental benchmark or not, there seems to be a general dissatisfaction with the inadequate funds available for new research and innovation in key subsectors. After a decade of CAADP engagement, many African stakeholders are starting to think that perhaps it would be prudent to have countries set their own realistic and context-specific targets in terms of budgetary allotment to agriculture.

Other sources of funding for R&D in Africa, besides government and donors include sale of research products such as publications at the Tanzania Forestry Research Institute (TAFORI). Commodity or *ad valorem* levies (especially for high-value crops like coffee, tea, sugarcane, and horticulture) also fund a higher share of research in Tanzania than in many African countries (Beintema et al., 2003). Prior to 2005, funds were channelled directly from stakeholders (farmers or commodity boards) but since then funds have been collected by the Tanzania Revenue Authority and remitted through the Treasury to the respective commodity research agencies. The level of such funding varies from 7% to 40% depending on fluctuations in commodity prices. Malawi and Zambia also fund research through levies on agricultural products or exports; tea and tobacco levies in the former and cotton levies in the latter.

Moreover, there are various innovations in the financing of agricultural extension. For example, the basket funding approach in Tanzania. This involves pooling of funds and distribution to end-users based on demand. Stakeholder forums consisting of farmer groups bring together concerns for required services from public or private agents. In Mozambique, extension is funded through government contracts to farmers. Thus, part of the payment for farmers' produce is directly channelled to extension service provision (Davis, 2008).

Generally, the gross agricultural spending pattern for a country relates to the respective national GDP level. For example, the levels of spending in agricultural R&D (USD$ 77 million in Tanzania, USD$ 69.6 million in Ethiopia and only USD$3 million in the Gambia) are much lower than those in relatively stronger African economies such as Nigeria (USD$404 million), South Africa (USD$272 million) and Kenya (USD$171 million). Generally, R&D expenditures and R&D expenditure shares of GDP for small developing economies that depend heavily on donor programmes are more volatile than those for larger economies (Beintema et al., 2012). In South Sudan, some USD$137.8 million is budgeted for the implementation of the National Agriculture and Livestock Extension Policy (NALEP); 21% of this is for operational costs on specific activities on agriculture while the rest is for general costs such as personnel and travels (Government of South Sudan, 2011).

ETHIOPIA: In Ethiopia, much of the research expenditure (48.6%) is accounted for by the national research institute – EIAR, while the seven regional agricultural research institutes (RARIs) account for 39.6% of expenditure and the eight higher education institutions take 11.8% of the research budget (NEPAD, 2011). Primary funding sources for agricultural R&D in Ethiopia are the national government, multi-and bilateral donors and development banks. The World Bank and IFAD have been the main sources of funding for agricultural research over the last ten years. Priority funding areas for these donors include managing agricultural research, strengthening agricultural research systems and developing human resource capacity. For instance, EIAR received funding to build capacity; Haramaya University got funding to develop

infrastructure and support the decentralization of research. Further, research-extension advisory councils and FRGs were established at the federal, regional and zonal levels to improve linkages with farmers and a competitive funding mechanism. The Agricultural Research Fund (ARF) was also established to facilitate competitive research funding on thematic areas relevant to national agricultural development goals.

SOUTH SUDAN: The South Sudan Development Plan (2011 – 2013) specifies an annual fiscal allocation of 4% to natural resources sector, which includes agricultural research and development. The country is eligible for competitive research grant schemes administered by ASARECA that specifies multi-stakeholder agricultural research and development. However, the success rate for research bids from Sudanese organizations has been very low compared to the other 'more developed' national research systems in the sub-region. This has prompted ASARECA to conduct a study on the human resource capacity needs of South Sudan in an effort to strengthen the competitiveness of key agricultural research organizations in the country[33]. The study revealed huge gaps in individual (research scientists at MSc and PhD levels) and organizational capacity (physical infrastructure). Further, the study indicated that there is no collaboration between University of Juba and the ministries, yet this is necessary since it will potentially contribute to capacity building and resource mobilization, among others. Innovation systems thinking does not appear to have taken root in this young and conflict-prone country.

MALAWI: Malawi has the Farm Input Subsidy programme on maize, legumes and dairy, funded by the DFID from 2011-2015. The DFID also supports Agriculture and Climate Change programme in the country.

NIGER: In Niger, agricultural research faced severe financial crisis after the closure of World Bank-funded National Agricultural Research Project - PNRA in 1998. The situation is expected to improve in the next few years due to on-going projects by the Alliance for Green Revolution in Africa (AGRA) and the World Bank loan-funded West African Agricultural Productivity Programme (WAAPP) focusing on livestock breeding in Niger. Although close to 17% of national expenditure is devoted to R&D, the absolute annual levels are low; USD$3.8 million at the main public research institute INRAN and USD$0.2 million at the CMB. The main donors to INRAN include AGRA, FARA, the McKnight Foundation and INTSORMIL-CRSP. The AGRA granted 33 million CFA franc for breeding of improved sorghum varieties, 312 million CFA franc for research on use of fertilizer micro dosing techniques annually from 2009 – 2012. The FARA supports learning-by-doing principle, which develops farmers' knowledge and experience through pilot learning sites. McKnight Foundation's contribution to INRAN was 259 million CFA franc from 2006 – 2009, for improving farmer access to sorghum and millet genetic resources and varieties. Finally, the INTSORMIL-CRSP also supported INRAN's millet and sorghum research at a tune of 233 million CFA francs (Stads et al., 2010). The WAAPP also focuses on research on fruits and vegetables in Burkina Faso from 2011.

ANGOLA: Innovation projects in Angola include Improvement of tolerant maize varieties to biotic and abiotic conditions by RDA South Korea, Rice culture promotion in Huambo and Bie provinces by JICA, and a study of soil and biodiversity of the basin of Okavango by the University of Hamburg, Germany. The FAO also supports local farmer groups' capacity for land management and natural resources in Huambo and Bie areas. It also builds capacity of provincial and district agricultural officers in Bamyan to work with innovation projects.

EAAPP: Currently, Ethiopia receives World Bank funding through the Eastern Africa Agricultural Productivity Programme (EAAPP) from 2009 until 2015. The EAAPP funding (USD$30 million) is channelled through EIAR for research on regional crop varieties. One of EIAR's research sub centres has been designated *a centre of excellence for wheat* for East and Central Africa under the EAAPP. In addition, bilateral funding to EIAR and Universities mainly targets crop-based projects; for instance, research conducted by the International Sorghum/Millet Collaborative Research Support Programme (INTSORMIL-CRSP). Other donors such as the Japan International Cooperation Agency (JICA), Swedish International Development Agency (SIDA) and United States Agency for International Development (USAID) provide funding to the RARIs. In the

[33]Kibwika, P., M. G. Nassuna-Musoke, and H. Sseguya (2013). Human resource capacity needs assessment of the less competitive national agricultural research systems in the ASARECA region. A consultancy report submitted to ASARECA. Unpublished.

competitive research grants category, the ARF provides up to USD$50,000 to individuals/institutes for research costs, while the Ministry of Science and Technology provides up to 25,000 Birr for research operating costs only. The EAAPP also funds research on rice in Tanzania.

AGRA: Recognizing the critical role played by finance in supporting the transformation of agriculture in other parts of the world, AGRA has identified innovative ways of mobilizing resources from within Africa. An initial undertaking in this regard was establishment of a credit guarantee scheme with the National Micro-Finance Bank, Tanzania, in 2008. AGRA put in $1.0 million and the partner $1.10 million. Later, other donors helped leverage $10 million. To date, some $9 million have been disbursed to 966 agro-dealers and the repayment rate is 97-98 per cent. Encouraged by the early progress in Tanzania, AGRA has replicated this financing model in a number of other African countries, including Mozambique.

Other innovation projects that involve collaborative research grants in Africa include (Chishala, 2013):

a) Development of drought tolerant maize for Africa [2007-2011] by CIMMYT, IITA, Bill and Melinda Gates Foundation (BMGF), HGBF in Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Tanzania, Zambia and Mozambique.
b) MIRACLE Project on agriculture and nutrition to improve health and nutrition status, food security and income of people with HIV/AIDS in Malawi, Zambia and Mozambique. The project is funded by the USAID, IITA and Feed the Future from 2011 to 2013.
c) Integrated Aquaculture and Small-scale Irrigation Development in Malawi, Zambia and Mozambique by the World Fish Centre (ICLARM) and BMZ at a cost of €1,200,000 from 2011 -2013.
d) Information services for food security in Ethiopia, Malawi, Niger and Mozambique by IFPRI and BMZ at a cost of €1,200,000 from 2009-2012.
e) Enhancing food productivity, food security and livelihoods in drought prone areas of Mozambique, Tanzania, Philippines, Nepal and India from 2011-2013 by International Rice Research Institute (IRRI) and BMZ at €1,200,000.
f) Improving beef production in Zambia and Mozambique by Common Fund for Commodities (CFC) and Golden Valley Agricultural Research Trust (GART) from 2011-2015 at €1,200,000.
g) Maximizing impact of social services expenditures on agricultural labour productivity in Burkina Faso, Mozambique and Tanzania by IFPRI and BMZ from 2010-2012 at €1,200,000.
h) Enhancing adaptive capacity of agro-pastoralists to climate change in Kenya, Mali and Mozambique by the International Livestock Research Institute (ILRI) and BMZ from 2008-2011 at €870,000.
i) Promoting safe and fair food in Ethiopia, Ghana, Kenya, Mali, Mozambique and Tanzania from 2008-2012 by ILRI and BMZ at €1,049,928.
j) Support of the design, implementation and evaluation of cash transfers in Lesotho by the FAO, DFID and UNICEF at £998,804 from 2011 – 2014.
k) Transforming savanna environment in Mozambique supported by the Future Agriculture Consortium, DFID, Brazil and China.
l) In November, 2011 Musika Zambia was launched as a Zambian owned company developing innovative and home-grown solutions for the Zambian agricultural market. By the end of the first year, Musika was working with 39 corporate clients in input, output, service, finance and environmental markets in all ten provinces of Zambia. Musika is also working closely with five industry associations and the government to ensure that its work benefits smallholders across the country. Musika began 2012 with 30 billion Zambian Kwacha support from the Swedish Embassy that allowed the organization to kick-start its operations. By its first anniversary, Musika had received an added 40 billion Zambian Kwacha from the DFID, which is enabling a rapid scale up of activities across the country and across the agricultural sector. Starting with 20 staff, Musika, by end of 2012 had 34 staff in management, operations, Knowledge Management, and administrative support. Last year, Musika signed a Joint Financing Agreement with Sweden and DFID amounting to $20 million over a period of 2-3 years.

As CAADP post-compact countries, all the 15 countries are 'signatories' to the Maputo Declaration of 2003 that specifies allocation of at least 10% national budget to agriculture. According to information posted on the CAADP website (http://www.nepad.org/foodsecurity/agriculture/about), only four countries (Burkina

Faso, Ethiopia, Malawi and Niger) out of the fifteen targeted for review have surpassed the CAADP target. However, even in these countries, a major chunk of the meagre public budgetary allocation to agriculture goes into recurrent expenditures, food reserves or input subsidy, with little left for research. Thus, research is heavily dependent on donor funds, which is rather precarious from a sustainability point of view. In the current wave of intensification for Africa's agriculture, technical innovation is a major driver for sectoral growth and agricultural research cannot be left to chance. This calls for institutional and policy innovations to have the private sector play an increasing role in funding research. Issues to do with IPR rights, proprietary research, cost of business, infrastructure, public versus proprietary goods, and so on must be addressed with a view to stimulating increased flows of private funding into public research institutions. In addition, clear instruments of engagements like MoUs will facilitate private sector engagement with public research agencies. Currently, private sector engagement in agricultural research to any appreciable degree is virtually non-existent in many of the reviewed countries. This is appalling, as Africa must increasingly look to the private sector for agricultural innovation funding.

The fee-for-service approach mentioned in Section 5.3.2 and the basket funding in Tanzania are good models for funding agricultural extension. AGRA's Credit Guarantee Scheme in partnership with local financial institutions also appears promising. Especially, with the introduction of the African Guarantee Fund by AfDB to cover risks, the financial institutions should be increasingly receptive to loan requests from farmers and small agri-enterprises. Governments would also help with fiscal policies that encourage banks to lower lending rates. In some African countries, not necessarily covered in this review, organized farmer groups have progressively transformed themselves into formidable savings cooperative societies that provide credits to members at rates way below those offered by commercial banks. These financing innovations can only thrive with supportive policy instruments and adequate actor capacity; hence, the role of TAP's Policy Dialogue and the Marketplace.

6. POLICIES AND REGULATIONS AFFECTING AGRICULTURAL INNOVATION

6.1 CAADP Framework, Regional and National Agriculture Policies

For nearly a decade, the CAADP has served as a reference framework for enacting regional, sub-regional and national policies on agriculture in Africa. The CAADP has two targets: increasing public spending on agriculture to at least 10% of GDP and increasing annual production to at least 6%. Table 3 shows the CAADP implementation status for the TAP countries. All the 15 countries have initiated country engagements on the CAADP, 67% have signed compacts and developed the National Agricultural and Food Security Investment Plans (NAFSIPs), 60% have developed implementation programs, secured funding and moved on to implementation of the programs.

Table 3: CAADP Implementation Status for TAP Target Countries

No	Stage of CAADP Country Implementation						CAADP Targets	
	Target country	National roundtable process initiated	Compact signed	NAFSIPs completed	Programs developed	Funding received from GAFSP[34] and program implementation initiated	10% budget allocated to agriculture	6% production p.a.
ASARECA								
1	Comoros	√	×	×	×	×	x	x
2	Ethiopia	√	√	√	√	√	√	√
3	Tanzania	√	√	√	√	√	x	√
4	Rwanda	√	√	√	√	√	x	X
5	South Sudan	√	×	×	×	×	x	x
CCARDESA								
6	Angola	√	×	×	×	×	x	√
7	Lesotho	√	×	×	×	×	x	x
8	Malawi	√	√	√	√	√	√	x
9	Zambia	√	×	×	×	×	x	x
10	Mozambique	√	√	√	×	×	x	x
CORAF/WECARD								
11	Benin	√	√	√	√	√	x	x
12	Burkina Faso	√	√	√	√	√	√	√
13	The Gambia	√	√	√	√	√	x	√
14	Niger	√	√	√	√	√	√	x
15	Liberia	√	√	√	√	√	x	x
% accomplished (√)		100	67	67	60	60	27	33

In terms of achievement of the CAADP targets, only four countries (Ethiopia, Malawi, Burkina Faso and Niger) have since allocated at least 10% of their annual budgets to agriculture; the so-called Maputo Declaration of 2003. Mozambique, on whose soil the Declaration was brokered, still falls short of this target posting only about 7% budgetary allocation to agriculture in the last couple of years. In terms of sectoral growth, only Ethiopia, Angola, Tanzania, Burkina Faso and The Gambia have attained the 6% annual target. Apparently, investing at least 10% of national budget to agriculture is not a precondition for the attainment of 6% growth target.

Rwanda was the first African country to sign the CAADP Compact in 2007. Since then, government policies guided by the Strategic Plan for Agriculture Transformation (SPAT) have been particularly supportive to the agricultural sector. Moreover, as illustrated above, there has been an appreciable donor support to the sector. It would then appear paradoxical that, six years post-compact, Rwanda has not attained to both the CAADP targets. However, the reality as depicted in Figure 3 suggests to the contrary; in fact, the country overshoot the 6% growth target in 2008 and 2009, has consistently posted an average growth rate of about 5% over the last five years, and was poised to surpass the 6% borderline in 2012 (Mbonigaba,

[34] Global Agriculture and Food Security Program (GAFSP) Trust Fund

2012[35]). A number of factors could contribute to the seeming underperformance by the other post-compact countries, not least of which would be the fact that sector

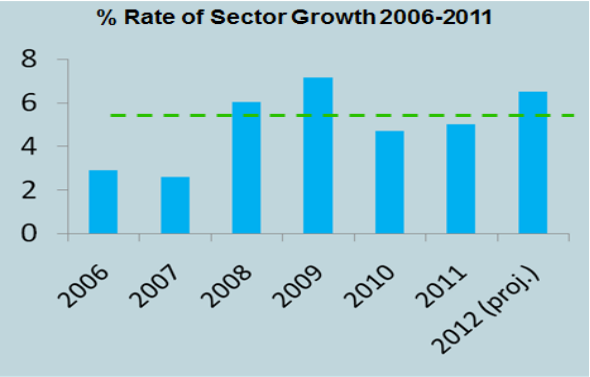

Figure 3: Agricultural sector growth in Rwanda
(Source: Mbonigaba, 2012**)**

development initiatives are often supply-led (donor funding do not necessarily address sector priorities) with general lack of coherence thereby precluding incremental gains. In many cases, there is no correspondence between policy and practice. On the other hand, majority of the countries lack the capacity to implement the CAADP NAFSIPs and many key actors (e.g. tertiary agricultural education institutes) are often left out in the formulation and implementation of agricultural programs.

Prior to and in parallel with the CAADP country processes, there have been consultations at the sub-regional level with a view to developing coherent regional policies on agricultural research and development. In the SADC sub-region, for example, such engagements were evident in the Declaration on Productivity of 1999; the SADC Regional Indicative Strategic Plan (RISDP) of 2003; and the Dar-es-Salaam Declaration on Agriculture and Food Security in 2004 (organized just around the time the CAADP was taking root) in which the Heads of State and Government noted that inappropriate national agricultural and food policies and inadequate access by farmers to key agricultural inputs and markets are still among the major underlying reasons for the prevalence of hunger in the region.

In August 2007, the SADC Council approved the revised priorities of the SADC Secretariat focusing on food security and management of trans-boundary, natural resources and environment. The need to adapt the agriculture and food security policy to take full advantage of related opportunities arising from deeper regional integration has led to the elaboration of the Regional Agricultural Policy (RAP) in 2012 to develop a legally 'binding' instrument to stimulate sustainable agricultural development and food security in the SADC region. The formulation of the RAP takes fully on-board the CAADP principles and therefore once finalized and approved, the RAP will constitute the Regional CAADP Compact for the SADC region (SADC, 2012). Similarly, sub-regional engagements have been underway elsewhere and almost all the three sub-Sahara regional economic communities (COMESA, ECOWAS, and SADC) have so far signed CAADP compacts and moving on to implementation phase.

As the Lead Institution for implementation of CAADP Pillar IV focusing on agricultural research, technology generation and adoption, FARA and partners developed the Framework for African Agricultural Productivity (FAAP) as an advocacy tool to help address the challenges prioritized by CAADP Pillar IV. The FAAP aims to strengthen agricultural knowledge systems to deliver profitable and sustainable technologies that are widely adopted by farmers resulting in sustained agricultural growth (FARA, 2011[36]). An important post-

[35] Mbonigaba, J. J. (2012). Sector Development and Approaches to Capacity Strengthening in Rwanda (1994 – to date). A paper presented at the Strengthening Capacity for Agricultural Innovation in Post-conflict and Protracted Crises countries Workshop, held 6 – 8 September 2012, Hotel Des Mille Collines, Kigali, Rwanda. FARA and GFAR, unpublished.
[36] FARA (2011). CAADP Pillar IV Strategy and Operational Plan (2011 – 2013). The Forum for Agricultural Research in Africa (FARA).

compact process at country and regional levels is the review of the NAFSIPs for compliance with the FAAP principles, which include, *inter alia*, provisions for:

- Empowerment of end-users to ensure their meaningful participation in CAADP country processes; in particular, setting priorities and work programmes for research, extension, and training to ensure their relevance
- Integration of agricultural research with extension services, the private sector, training, capacity building, and education programmes to respond in a holistic manner to the needs and opportunities for innovation in the sector

Thus, adherence to the FAAP principles in formulating the NAFSIPs and subsequent program implementations facilitates the emergence of functional national and regional agricultural innovation systems. The aim of the FAAP is to strengthen agricultural knowledge systems according to the principles enunciated in Box 1 at the national level.

Box 1: Abridged FAAP Principles (FARA, 2006)

Practical actions for farmer empowerment:

- Sensitise and mobilise smallholders and pastoralists to create groups or associations around economic activities (e.g., input and/or credit access, marketing, agro-processing
- Strengthen capacity of existing farmers associations and national producers organizations to provide more efficient services to members.
- Assist farmers organizations to participate in policy making, priority setting and governance of NARSs and advisory service systems.
- Promote the use of modern technologies and distance learning approaches to enable farmers and pastoralists to become knowledgeable and innovate with confidence.
- Link rural communities to markets through interactive information services that exploit modern information and communications technology (ICT) such as mobile phone short messaging services (SMS).

Practical actions for agricultural extension services:

- Contract out extension services.
- The costs of extension should be gradually shared with local governments, farmers associations, and eventually the producers themselves.
- Where knowledge and solutions are not available, formal and informal means should be in place to ensure that farmers as a group have a voice in decisions affecting research priority setting, funding, execution, and evaluation.
- Resources and mechanisms should be established to make it possible for farmers and extension systems to pay researchers, whether from the public or the private sector, to carry out on-farm participatory research.

Practical actions for agricultural research:

- When research is contracted out, the government role becomes one of financing, quality assurance and also provision of training and information to the organizations or individuals who have been contracted to deliver research services.
- Establish multi-year programmatic contract; and competitive grant schemes to support proposals in priority areas.
- The costs of public agricultural research programmes to be gradually shared between national and local governments and also with farmers associations, and agri-business.
- Establish national agricultural research strategies through participatory and multi-disciplinary processes—and their endorsement of these at national level through inclusion in the Poverty Reduction Strategies (PRSs).
- Greater emphasis should be given to human resource development and in the agricultural research system, through improved salaries, performance-related pay, better working conditions, and training opportunities.

Practical actions for agricultural training and education:

- Contextualise teaching in the management of risk and uncertainty related to smallholder agriculture, e.g., climate change, globalization, and international agreements and conventions.
- Prepare students better with the skills and tools they need for developing and implementing knowledge-based innovation systems.
- Improve integration of land use and environmental topics (including biodiversity, bioenergy, carbon sequestration, etc.).
- Enhance the enrolment of women, commensurate with their predominant role in the sector.
- Establish links in the education system from formal teaching to professional training.
- Create synergies among institutions and curricula in education, research and extension.
- Improve aspects of value adding, marketing and agri-business.

6.2 Biotechnology and Biosafety Policies

African leaders adopted a Science and Technology Consolidated Plan of Action (CPA) to harness Science and Technology. One of the flagship programs of the CPA is the African Biosciences Initiative (ABI), which focuses on research and development (R&D) in the areas of biotechnology, biodiversity, indigenous knowledge systems and technology. The sub-regional economic communities have since established their respective biosciences regional networks to pool infrastructures and human resources for R&D at regional levels. These are the Southern Africa Network for Biosciences (SANBio) for Southern African countries; Biosciences Eastern and Central Africa Network (BecANet) for Eastern and Central African countries; West Africa Biosciences Network (WABNet) for West African countries and North Africa Biosciences Network (NABNet) for North African countries. Each of the sub-regions has been designated a core mission, much in the spirit of regional centres of excellence, as follows: Central Africa - Forest Biotechnology; Eastern Africa - Animal Biotechnology; Northern Africa - Pharmaceutical Biotechnology; Southern Africa - Health Biotechnology; and Western Africa - Crop Biotechnology.

Currently, virtually all African countries are signatories to the Cartagena Protocol on Biosafety and several biosafety and biotechnology initiatives exist in the continent to stimulate policy engagements exemplified by the following: African Union (AU) Biosafety Project, New Partnership for Africa's Development (NEPAD) Africa Biosciences Initiatives and African Biosafety Network of Expertise (ABNE), Forum for Agricultural Research in Africa (FARA)- African Biotechnology Biosafety Policy Platform (ABBPP), Program for Biosafety Systems (PBS), Agricultural Biotechnology Support Project II (ABSPII), NGOs like AfricaBio, International Service for the Acquisition of Agri-biotech Applications (ISAAA), Biosafety Resource Network (BRN), African Biotechnology Stakeholders Forum (ABSF) and Africa Harvest Biotechnology Foundation International (AHBFI) to facilitate development and safe application of genetically-modified (GM) crops in Africa.

As shown in Figure 4, Burkina Faso was the pioneer African country to enact biosafety policies in 2003 and by 2006 had moved on to commercial production of GM cotton. Progress in Malawi has been rather rapid having enacted biosafety laws only in 2007, but has already permitted confined field trials (CFT) on GM crops. Ethiopia, Mozambique, Tanzania and Zambia have established Biosafety Laws without CFTs, while Angola, Benin, Comoros, Liberia, Niger, Rwanda, South Sudan and The Gambia have no Biosafety Laws or CFTs. In 2007, FARA initiated the SABIMA program to strengthen capacity for biotechnology and biosafety stewardship in six SSA countries including Burkina Faso and Malawi that perhaps has catalysed the indicated progress in these countries.

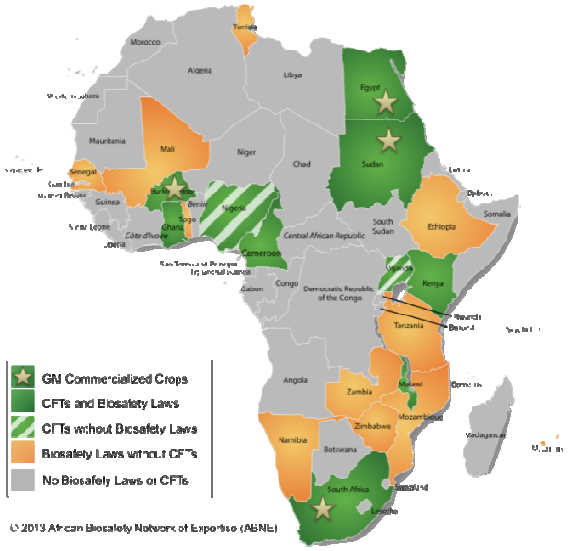

Figure 4: Status of Biosafety Regulations in Africa[37]

[37] http://www.nepadbiosafety.net/subjects/biotechnology/status-of-crop-biotechnology-in-africa

6.3 Climate change policies

At CAADP inception in 2002, climate change had not attained the level of planetary emergency it now commands. Thus, it was just an allusion in the initial CAADP document and there was no conceptual vision for regional action. Nevertheless, African countries have been persuaded to voluntarily domesticate climate change actions at home front due to the COP series of engagements. Many countries have since formulated climate change-related policies and institutional arrangements (not necessarily on agriculture) for local action guided primarily by the United Nations Framework Convention on Climate Change (UNFCCC) unveiled in Rio, Brazil, in 1992 and the subsequent Kyoto Protocol of 1997.

The attention to and handling of agriculture in international climate change negotiations has been guarded and modicum. Indeed, the particular mechanism under which to consider agriculture in climate change policies has not been clear. Due to deforestation, some want agriculture to be considered under the REDD+ mechanisms on mitigation and others want it under the NAMAs provisions on adaptation. The vacillating commitment to mainstreaming agriculture in the global climate change negotiations has affected, to a good extent, the elaboration of climate change policies in agriculture at country level.

African leaders and stakeholders meeting at the 5th CAADP Partnership Platform in Abuja, Nigeria, in 2009, called for the formation of the CAADP Climate Change Adaptation Framework (CCCAF). The CCCAF is an African agricultural-based climate change adaptation framework. It is meant to integrate climate change adaptation in the CAADP Pillar 1 Framework and thereby serve as a guide to regional, sub-regional and national engagement on climate change adaptation and mitigation. Thus, CCCAF will ensure climate change issues are embedded in the CAADP NAFSIPs and effectively endorses innovations in conservation and climate-smart agriculture.

The main action areas for CCCAF are: 1) creating and sustaining enhanced capacity in the areas of organisational development, monitoring and evaluation, peer learning, evidence-based analysis and policy dialogue; 2) financing of investments and capacity development; 3) improving productivity, especially by embedding resilience principles at smallholder level. Preparation of the CCCAF document (now known as the AUC Agriculture Climate Change Adaptation-Mitigation Framework) was completed in 2010 and many countries and RECs have yet to embed its principles in their compacts and investment plans.

Although the policy nexus has lagged, there have been isolated actions by various stakeholders throughout the continent to mitigate the effects of climate change on agricultural practices. An example is AfricaAdapt, a pan-African network for knowledge sharing on climate change adaptation co-hosted by FARA, researchers, policy makers, civil society and other communities vulnerable to climate change. AfricaAdapt has produced policy briefs, provided funding to 22 local communities on various adaptation measures, and organized knowledge sharing events like 'meet and greet' sensitization workshops. Recent developments like the G8's Technology Platform are adding impetus to engagements on climate change. Under this Platform agricultural risk management is a key issue and risks associated with climate change on smallholder agriculture are being advocated by FARA and stakeholders.

A lot still needs to be done in terms of policies and actions, for example: 1) embedding climate change and climate-smart agriculture issues in national development instruments and cascading to lower levels for action; 2) capacity development for climate change forecasting and info systems for targeted and adaptive agriculture; 3) establishment of competitive grant schemes for universities and research institutes on climate change at SRO and national levels; 4) establishment of CoEs on climate-related technologies at SRO and national levels; 5) evidence-based policies on climate change adaptation and mitigation i.e. based on research findings; and 6) enhancing capacity to respond to challenges of climate change through cutting-edge science.

6.4 Intellectual Property Policies

Favourable intellectual property (IP) regimes and policies can be powerful incentives to innovation, even in the agriculture sector, as they secure the innovators' interests in appropriating benefits from their efforts. Thus, the protection of ideas and the promotion of creativity and innovations through intellectual property rights (IPR) has become one of the major priorities of firms and nations worldwide. As agriculture becomes more knowledge-based and innovation-driven, the issue of how knowledge is created, disseminated, retained and used to obtain economic returns (as encapsulated in the agricultural innovation systems concept) is compelling.

African states adopted the World Intellectual Property Organisation (WIPO)'s Development Agenda (DA) in 2007 (Ncube, 2013[38]), but so far, only COMESA has formulated a sub-regional IP policy. The other two RECs, SADC and ECOWAS are yet to elaborate their IP policies, although ECOWAS has an industrial policy in place since 2010. Similarly, at the continental level, engagements toward structures and policies on IP have been rather protracted. The idea of a Pan African Intellectual Property Organisation (PAIPO) has been on the mind of African leaders for close to a decade, but it has never come to fruition. However, engagement platforms like the Africa IP Forum have served to sustain the debate. Currently, many African countries have IP legislations that they inherited from their colonizers and have had to review to comply with the Agreement on Trade Related Aspects of IP Rights (Ncube, 2013). The utility of these IP regimes in stimulating local innovations is however uncertain. Like WIPO, other international agreements exist such as the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), Convention on Biological Diversity (CBD), Inter-governmental Committee on Intellectual Property and Genetic Resources (IGC-IPGR), International Treaty on Plant Genetic Resources Food and Agriculture (IT-PGRFA) and others. However, lack of policy coherence hinders translation of these agreements at national level. The challenge here is to match the agreements to local issues such as national food security, poverty alleviation, economic development, biodiversity and health.

6.5 ICT Policies

Innovations thrive where there is effective knowledge and information flows. Efficient knowledge and information management systems can address inherent risks and problems of information asymmetry that aid market distortions in agricultural value chains. Information and communication technology (ICT) can play a critical role in facilitating rapid, efficient, and cost effective knowledge management. The mobile phone revolution and its increasing interphase with the Internet have especially made it possible to leverage ICT capabilities for the benefit of smallholder farmers. Through ICT, farmers can readily access advisory services, environmental and climate-change-related alerts, input supplies and market information.

By 2012, about 45 African countries had national ICT policies in place and six of them including Ethiopia, Lesotho, Mozambique, and Rwanda specified agriculture as a key pillar. In the case of Lesotho, the ICT Policy clearly integrates agriculture and food security in its strategic framework. Key strategic areas identified for ICT intervention in agriculture include crop planning; monitoring and forecasting; and livestock registration, marking and information systems (LRMIS), which can prevent theft and be used to control disease by tracking and locating livestock around the country. Specific actions areas include computerising all agricultural management records, providing online access to relevant data (techniques, weather forecasting, pricing and market information) to national & district level stakeholders, developing & maintaining a national GIS system to monitor agricultural land use & manage national resources.

The National ICT Policy of Mozambique was approved in 2000 with agriculture and natural resources as one of the areas for strategic focus. The main challenges to be tackled by ICT under agriculture and natural resources include lack of databases about national agricultural potential, lack of weather forecasting to prevent natural resources and lack of a system addressing wild animal migration. Opportunities for the

[38] Ncube, C. B. (2013). The Development of Intellectual Property Policies in Africa- Some Key Considerations and a Research Agenda. Intel Prop Rights Volume 1 • Issue 1 • 1. http://dx.doi.org/10.4172/ipr.1000101

application of ICT include disseminating techniques for land conversation and preservation, sharing resources on wild animals at risk, leveraging GIS technology and creating a national network linked to regional networks (e.g. FARA's e-RAILS) to exchange experiences and information.

Rwanda elaborated the first national ICT Policy in 2001. The Policy has been implemented in three phases as follows: Phase 1 from 2001 to 2005, Phase II from 2005 to 2010, and currently, Phase III being implemented from 2010 to 2015. The main impacts of the ICT policy on agriculture have been threefold: mobile and Internet-based agricultural transactions, Fertilizer Voucher Management System, and Post-Harvest Silo Management System. The Government of Tanzania developed a National Information and Communications Technology Policy in 2003. However, the Policy has no specific focus on agriculture being lumped broadly in the wider productive sector.

6.6 Policies Supporting Smallholder Participation in Innovations

Although, almost all the African countries reviewed have national-level policies on agriculture, very few of them have specific interventions that directly deal with development of innovations for or support of the smallholders at the rural farm level. Thus, the national policies have not been implemented to the grassroots level[39]. This lack of focus on grassroots actions is the bane of Africa's agriculture. Even the transformational agenda of the CAADP may not achieve desired impacts unless there are clear channels and actions for cascading policies to the grassroots. Exceptions include Benin, Malawi, Mozambique, Rwanda, Tanzania and Zambia. For instance, Mozambique has a strategic plan for agricultural decentralization, which if well implemented would promote extension outreach and involvement of many local farmers in the innovation process. Tanzania has a supportive Cooperative Act that facilitates small farmer group registration, while Malawi has a farm input subsidy policy.

Rwanda, Benin and Zambia have specific R&D, and innovation policies that promote collaboration, scale-up and private sector investments in agricultural innovations. For instance, there is reduced business red tape in Rwanda, which has a one-stop department for processing of all international business permits, i.e., the Rwanda Development Board. Further, Benin, Rwanda and Tanzania have producer associations (FUPRO, IMBARAGA and MVIWATA, respectively) through which producers define their innovation needs, priorities and challenges.

In **Tanzania**, various legal mechanisms exist for farmer group registration as cooperatives, associations or trusts. Groups such as the seed growers associations in the Lake Zone and FFS groups in Bukoba, Morogoro and Mbinga districts are legally registered entities with strong binding governing constitutions. Others are legally registered under the Cooperative Act (No. 15, 1991) or listed by the Community Development Department. Under the ZARDIs, FRGs as platforms that monitor and evaluate on-farm research activities closely, provide feedback from farmers to researchers and other stakeholders. The focus on limited sites and agro-ecological environments ensures greater efficiency and better sharing of experiences among stakeholders. The main producer organization, MVIWATA works closely with agricultural R&D organizations and is a member of several national steering committees and boards. Internationally, MVIWATA networks with other FOs and has links with NGOs and funding partners. MVIWATA's main strength is its credibility with both farmers and other agricultural innovation stakeholders who recognize it as independent from the government and publicly funded services. Farmer forums are being established in Tanzania at ward, district and national levels and are empowered to procure and contract services. Thus, the formidable institutional set up, active engagement of end-users, and presence of brokerage agents like MVIWATA linking up various actors most likely account for the positive sector performance in Tanzania.

Existing FOs play a key role in innovation by linking community-based farmer groups into larger networks such as MVIWATA and by representing their members in decision-making platforms in agricultural service provision. One such forum is the MVIMAMO, which is a relatively young member district network under

[39] As part of efforts to address this shortcoming, the FAO provides policy assistance to governments to address small producers' needs. It also provides capacity development to create an enabling environment and foster representation and participation of producer organizations as key stakeholders in agricultural and rural development policy formulation.

MVIWATA. It aims to assist farmer groups in networking activities by promoting agricultural technological innovation. This is achieved by organizing thematic workshops, visiting community farmers who are successful innovators, and by organizing exchange visits both inside and outside Tanzania. The effectiveness of these visits for the community is monitored through a learning approach, with the farmer groups involved and their network meeting on a regular basis to discuss successes and failures.

In **Rwanda**, a national farmers' association (IMBARAGA) assisted potato-producing associations to form federations that lobby for their interests and negotiate with the private sector. In collaboration with public sector service providers and NGOs, IMBARAGA facilitated farmer participation in research and extension. Researchers are encouraged to conduct on-farm research, while extension agents train farmers to conduct farmer-to-farmer extension. IMBARAGA combines the value chain and community approach when organizing knowledge-for-innovation services. Through their participation in platforms with other chain actors, federations are informed about market demands and farmer extensionists promote knowledge transfer into a local community context (Wennink and Heemskerk, 2006). However, Rwanda, which together with Benin has established legal frameworks for application of knowledge within and outside their boundaries, has a restrictive political environment that hinders formation of groups.

In Zambia, collaboration amongst agricultural research agencies is robust and one may observe that the landscape has embraced agricultural innovation thinking to a reasonable extent (Flaherty and Mwala, 2010). Due to favorable policies set by the Government of Zambia, private actors engaged in advisory, extension and information services have flourished. Self-organized groups like the Agricultural Consultative Forum and the Agribusiness Forum have mediated consultation, networking and information sharing amongst stakeholders involved extension work. This has enabled end-user engagement in determining extension priorities as well as encouraging private entrants into the fray. Farmer associations like Zambia Cotton Ginners Association (ZCGA), Grain Traders Association of Zambia (GTAZ), Zambia Export Growers Association (ZEGA), and Zambia Seed Traders Association (ZSTA) are also actively involved in extension work and value chain development.

Local NGOs have also sprung up to play an important role in agricultural extension, but there is need for the government to strengthen their capacity in key areas to enable them render more effective services to the farmers. A number of farmer-based organizations exist in Zambia, usually organized along specific commodities or farming interests to access credit, markets, and lower transaction costs related to input supply and technical advice. The main producer organizations and their representatives in Zambia include Zambia National Farmers Union (ZNFU), Conservation Farming Unit (CFU), Farmer Organization Support Program (FOSUP), National Peasants and Small-Scale Farmers Association, Large-Scale Commercial Representative, and Smallholder Farmers Representative. However, there are still challenges of research-extension-farmer linkages in Zambia. Moreover, there is need for greater integration between ministries concerned with extension, including those concerned with information and communication, to embrace ICT-based approaches to extension.

In Mozambique, although one of PEDSA's strategies is "strengthen mechanisms for establishing research priorities that are demand-led, market-oriented and innovatory, taking into account the needs of specific groups such as women", there is minimal influence of farmers' needs and challenges on agricultural research priorities and extension packages. However, research grant schemes that favor collaborative ventures and smallholder agenda is unclear in existent policy documents. Further, specific share of budget allocation to agricultural research is unclear as are the national agricultural research priorities.

Mozambique also has a land governance system that allows for strong protection of community-based land rights, promotes community consultation with respect to partnerships with investors, and secures rights to land for investors. However, the implementation of legislation has been slow and the capacity among state

actors is weak[40]. Awareness of land rights by rural communities is low and delimitation of community land and registration of community land rights is limited.

6.7 Extension Policies

Historically, extension and advisory services in Africa have been the preserve of public extension departments within the agricultural line ministries. Thus, the decade of the World Bank's structural adjustment programs - characterized by huge cuts in public spending - virtually asphyxiated extension and advisory services in many African countries. To date, many countries are still struggling to resuscitate their public extension services. In the intervening years, NGOs, farmer groups, input suppliers, research institutions, and universities have strived to varying degrees to fill the void, thereby heralding pluralism in extension provision. As various actors have progressively entered the fray over the years, so have been innovations in the mode and scope of agricultural extension financing and delivery (see Section 5). Furthermore, various approaches and methods of extension provision have also come forth.

A major problem of organizing agricultural extension in African countries is the pervasive lack of a legal and policy framework to guide extension provision. Even globally, there are few examples of validated national agricultural extension policies. In 2011, more than 400 stakeholders from across the globe gathered in Nairobi, Kenya, for an international conference on "Innovations in Agricultural Extension and Advisory Services: Linking Knowledge to Policy and Action for Food and Livelihoods." At the end of the four-day conference, the participants unveiled the "Nairobi Declaration on Agricultural Extension and Advisory Services." The foremost call in this Declaration was for governments, extension professionals, farmers', organizations, regional and global bodies, the private sector, civil society, development partners and donors to work together to "develop clear policies and strategies for extension and advisory services in a participatory manner and put coordination and quality assurance mechanisms in place."

Subsequently, the Government of Kenya managed to pass a comprehensive National Agricultural Sector Extension Policy (NASEP) in 2012 with the objective of "empowering the extension clientele through sharing information, imparting knowledge and skills, and changing attitudes so that they can efficiently manage their resources for improved quality of livelihoods". For the TAP countries, only Malawi has an extension advisory services policy in place, while Liberia is in the process of developing one.

In 2004, the African Forum for Agricultural Advisory Services (AFAAS) was formed as an umbrella organisation for Agricultural Extension and Advisory Services (AEAS) in Africa with the objective of creating efficient, effective and synergistic linkages and partnerships between AAS of member countries to improve the delivery of these services to farmers. AFAAS (http://www.afaas-africa.org/) is a CAADP Pillar IV institution; hence, FARA has spearheaded its development. AFAAS seeks to enhance partnership with various AEAS agencies that work at country, regional and global levels. It also seeks to support a consultative process of AEAS fora formation at country level, definition of their operational and strategic plans, strengthening their capacities, and improving their advisory service systems. The country AEAS fora aim to provide a mechanism for the diverse actors – including farmers – to exchange information, share lessons, identify opportunities for providing services to each other, and for innovating on how to provide advisory services in their domains of work (Chipeta, 2011) [41]. So far, Malawi and Mozambique already have constituted country AEAS fora and other countries are following suit. It is expected that AFAAS, through the respective country AEAS fora, will be a catalyst in policy development and transformation of AEAS in African countries.

6.8 Country-based Examples

The FAO's Investment Centre Division (TCI) assists various African countries to develop their national agricultural sector investment programmes (NAPs) based on their national CAADP compacts. This is

[40]Hilhorst, T. and N. Porchet (2011). Mozambique - Food Security and Land Governance Factsheet prepared by the Royal Tropical Institute (KIT), Ministry of Foreign Affairs – The Netherlands.

[41] Chipeta, S. (2011). Establishment and strengthening of AFAAS Country For a. Paper presented at the AFAAS Symposium and Annual General Assembly, 2011

followed by TCI support to countries in formulating post-CAADP compact investment strategies, plans and programmes. TCI has collaborated with Ethiopia, Gambia, Malawi, Mozambique, Niger, Rwanda and Tanzania by facilitating the participation of producer's associations in the preparation of such plans and programmes. Details of the CAADP investment plans and national policies for some of the countries are discussed below (further information can be found in Table 5).

a) Ethiopia

Priority setting for agriculture and rural development in Ethiopia is undertaken within the Policy and Investment Framework (PIF), which is a government initiative led by the Ministry of Agriculture and Rural Development. The CAADP's major contribution to the development of PIF in Ethiopia has so far been to focus and harmonize the approach of donors to agriculture and to improve their understanding of government policies (Federal Democratic Republic of Ethiopia, 2010). However, there is still widespread perception that smallholders/poor farmers are not well represented and that the government is unwilling to accept participant's input in policy making processes (NEPAD, 2011).

b) Rwanda

Rwanda has a relatively strong political commitment to agricultural development as illustrated by the fact that it was the first country to sign the CAADP compact in March 2007, and it was the first country to hold high-level stakeholder meeting and investment plan technical review. The Government of Rwanda has a sound agriculture development strategy supported by a detailed country investment plan. At the national level, the:

a. Rwanda Vision 2020 lays out strategy to transform the country's economy into a middle-income country by 202. It is also built around 6 pillars including productive and market-oriented agriculture
b. Economic Development and Poverty Reduction Strategy (EDPRS) provides medium-term framework for achieving long-term development goals. It also provides guidance for sectoral planning.

At the agriculture-sector level:

a) The Strategic Plan for the Transformation of Agriculture in Rwanda (PSTA II) outlines four major programmes and 20 sub-programmes as planning framework for EDPRS. It provides cost and performance metrics. It also aligns donor partners around Government of Rwanda strategies.
b) The Agriculture Sector Investment Plan (ASIP) lays out investment plan for Rwanda agriculture strategy. It also identifies commitments from Government of Rwanda, donors, development partners, private sector and the investment gaps.

Priority areas that would enable further transformation of Rwanda's agricultural innovation include:

a) Provide competitive research grants to support indigenous research efforts (field trials, conferences) and capitalize on international crop science advancements
b) Continue to provide technical assistance and policy dialogue directly supporting Government of Rwanda info-resource management
c) Develop innovative behaviour change interventions to improve nutritional practices especially among rural families
d) Support investment in post-harvest handling and storage
e) Create value chain appropriate nutrition interventions e.g., fortification capacity in processing centres
f) Increase capacity and effectiveness of Rwanda education and research institutions through fellowships, improved internal/external coordination.

On the institutional level, the RAB has the overall mission to coordinate agriculture and animal husbandry research and extension in Rwanda. Its specific roles include to: determine and implement national policy in agriculture, animal husbandry, research and technology; provide information to farmers and consumers of agricultural products; identify and provide new technologies on land and water management and agricultural mechanization; coordinate agricultural extension and ensure dissemination at zonal levels; collect national and international innovations and new technologies and refine them for use in Rwanda; and coordinate activities of other service providers in agriculture, including NGOs. In addition, the National

Agricultural Export Board (NAEB) formulates and implements policies and strategies for developing exports of agriculture and livestock products. It also supervises, facilitates and trains private operators and cooperatives involved in agriculture and livestock production for export.

c) South Sudan

The Ministry of Agriculture and Forestry (MAF), Ministry of Animal Resources and Fisheries (MARF) with the support of the Norwegian Peoples Agency (NPA) and other donors recently developed an Agricultural Extension Policy Framework (Government of South Sudan, 2011). The framework aims at enhancing knowledge, changing attitudes, behaviour and improving skills for farmers and extension workers in order to increase and improve farmers' incomes and productivity.

d) Tanzania

In Tanzania, the Commission for Science and Technology (COSTECH) coordinates all science and technology policy and research agencies including the agricultural sector (Beintema et al., 2003). The Agricultural Sector Development Strategy (ASDS) is the strategic blue print for the development of agriculture. The ASDS has five strategic priority areas that are in line with the CAADP objectives and principles. The ASDS priority areas are:

i) Strengthening the institutional framework to facilitate partnership and coordination in developing the agricultural sector
ii) Creating a favourable environment for commercial activities
iii) Public and private partnership in improving agricultural support services
iv) Strengthening marketing efficiency for agricultural inputs and products
v) Mainstreaming agriculture in the decentralised planning process under the local government authorities (LGAs).

In order to provide more emphasis to a private sector-led development of agriculture, the Tanzanian government in collaboration with private sector players has formulated the '*Kilimo Kwanza' ('Agriculture First')* Initiative and Agricultural Transformation Initiative (ATI) for Tanzania Mainland and Zanzibar, respectively. Planned policy interventions to achieve private sector-led agricultural transformation include:

i) Review of relevant agricultural policies in order to harmonize them and allow private sector participation
ii) Strengthen the regulatory framework for production and distribution of inputs, promoting out-growers schemes, agro-processing, trade and marketing
iii) Review the legal and institutional modalities for land delivery and management in order to improve efficiency in the acquisition and securing of land for private sector investment
iv) Provide tax incentives, agricultural input support and trade policies
v) Creating new models for cooperation between the public and private sector in rural development at all levels, new ways of establishing and enforcing grades, standards and new emphasis on improving the investment climate for agriculture.

The priority investment areas in Tanzania are:

i) Increasing productivity especially in maize, millet and sorghum by investing in irrigation (Pillar I), mechanization (Pillar I and III), research and development, and extension (Pillar IV), use of improved agricultural inputs (Pillar III), renewable natural resources, environment and climate change
ii) Market expansion through improvement of rural infrastructure (roads, markets, storage facilities, electrification) (Pillar II), and agro-processing and value addition (Pillar II)
iii) Promotion of public-private sector partnership
iv) Capacity building at all levels.

Implementation of the ASDS is by the Agriculture Sector Lead Ministries (ASLMs), which include the Ministry of Agriculture and Food Security (MAFS), the Ministry of Cooperatives and Marketing (MCM), and the President's Office – Regional Administration and Local Government (PO-RALG).

e) Angola

A strategy for reviving agriculture was developed in 2005. It focuses on promoting a market-oriented agriculture at large-scale and smallholder farms. Key priority areas include to increase spending in agriculture; eliminate limits on marketing margins for traders; coordinate public and private provision of market information; assist development of farmer associations; and capacity building for extension staff. Moreover, in March 2008, the Government of Angola published its National Food and Nutritional Security Strategy (ENSAN). This strategy, coordinated by the Ministry of Agriculture, was created through a process that involved an inter-ministerial technical team from nine ministries; public consultation, including regional conferences; substantial internal discussion; and large scale external discussion. A National Food and Nutritional Security Action Plan (PASAN) was developed from the ENSAN. Five strategic areas and four implementation areas are defined in these important documents focusing on increasing and diversifying production, strengthening capacity at family and local association level and fostering scientific research.

f) Lesotho

The Strategic Development Plan for Lesotho has three main priority areas (Government of Lesotho, 2012):

- Reducing vulnerability and managing risk through: promoting improved farming techniques in land and water management, post-harvest handling techniques, homestead and keyhole gardening, open pollinated variety seeds and rearing of short cycle animals; scaling up conservation agriculture and linkage with private sector; strengthen early warning system in agricultural research

- Commercializing agriculture by: implementing Land Act/reform of block farming programme; demarcation of land according to its potential for crop production and range use; fast tracking policies on irrigation, seeds and standards; and train extension officers and farmers in agricultural marketing and business skills

- Strengthening institutional capacity through: leadership and business skills training for all agricultural institutions; review of staff incentive packages; allocating funds for proper and regular monitoring and evaluation of agricultural sector performance; developing agricultural coordination task teams on cross-sectoral issues

g) Malawi

The policy framework in Malawi comprises the Malawi Growth and Development Strategy (MGDS I&II) that identifies agriculture as key to economic growth and poverty reduction. In order to facilitate the growth of the agricultural sector in line with the CAADP pillars, the Malawi government and its development partners formulated the Agriculture Sector Wide Approach (AsWAP) in 2010. The priority areas for agricultural investment under the AsWAP are (Mloza-Banda, 2012):

i) Food security and risk management through increased maize productivity and reduced post-harvest losses; diversification of food production and dietary diversification and risk management for food stability.
ii) Commercial agriculture, agro-processing and market development.
iii) Sustainable agricultural land and water management
iv) Provision of key support services including technology generation and dissemination, institutional strengthening and capacity building.

h) Mozambique

Mozambique has developed a ten-year Strategic Plan for the Development of Agriculture Sector (PEDSA) (2011 – 2020). The Agricultural Research Institute (IIAM) also has a strategic plan on decentralization of agricultural service provision. Both plans focus on smallholders and their empowerment, provide for private sector involvement in research and extension, and encourage collaborations amongst sectoral actors. The PEDSA identifies strengthening research systems in Mozambique to develop or adapt and make available advanced technologies and agricultural practices as one of the national strategies for development of the commodity-specific cluster corridors. The PEDSA also specifies creating effective and on-going links between research, extension, farmers and other actors as one of its strategies.

i) Zambia

The key agricultural development programmes in Zambia include (Phiri, 2013):

- Agricultural productivity improvement programme focusing on intensification of crop, livestock and fisheries production; agricultural finance innovations through increased private sector participation, and farm block development to increase land area under cultivation.
- Sustainable land management programme focusing on conservation farming, aforestation, protection of fragile land and rehabilitation of degraded agricultural land.
- Management of water control systems involving rehabilitation of irrigation infrastructure and protection of wetlands.

j) Benin

The White Paper on Agricultural Advisory Services was launched in 2004. This was followed by the National Strategy for Implementation of Agricultural Advisory Services in 2008. It focuses on specialized technical advice, management advice for farms, advice for accessing markets, and advice for local organization and planning – with each stakeholder's role identified.

k) Burkina Faso

The National System for Agricultural Extension and Advisory Services was formed in 2010. it aims to rationalize the support provided to farmers, whether by private or public advisors in order to avoid duplication of efforts and total dependence on donors for advisory services.

l) Gambia

The Gambia National Agricultural Investment Programme (GNAIP) aims at increasing agriculture sector growth from 26% to 60% per annum by 2015. It focuses on six key programmes:

i) Improvement of water management at an estimated cost of USD$63 million, government contribution is USD$6 million

ii) Improvement in the management of other shared resources including range management, organization of transhumance, shared forest resource management and support to fisheries management. Estimated cost is USD$15 million, with a funding gap of USD$14 million

iii) Development of agricultural value chains and market promotion. This is estimated to cost USD$106 million and the government contribution is only USD$10 million

iv) Prevention and management of food crises and other natural disasters at an estimated cost of USD$40 million, government contribution is USD$4 million

v) Sustainable farm management, estimated to cost USD$22 million, with government contribution of USD$2 million

vi) Institutional capacity building for programme implementation. This is estimated to cost USD$14 million, but the funding gap is USD$13 million.

m) Liberia

In Liberia, the Liberia Agriculture Sector Investment and Development Programme (LASIP) has four major sub-programmes that seek to expand agricultural production by about 3.6% per annum from 2011 to 6% per annum by 2015, and thus achieve the CAADP priorities. These include:

i) Land and water development – main components are land policy reform and capacity building; enhanced land husbandry; expansion of irrigable land; improved wetland and degraded land management. The estimated cost of this is USD$35 million.

ii) Food and nutrition security – include food crops production and productivity enhancement; improved nutritional status and management of food emergencies; smallholder tree crops and agro-forestry development; sustainable fisheries subsector development; livestock development and promotion; special women and youth initiative. Estimated cost is USD$60 million.

iii) Competitive value chains and market linkages – key components are rehabilitation and expansion of rural roads; rural agricultural infrastructure and energy; rural financial services;

labour-saving intermediate devices and technologies; market and enterprise development, all estimated to cost USD$115 million.

iv) Institutional development that entail rebuilding the Ministry of Agriculture and agricultural parastatals; revitalizing agricultural research; technology dissemination and adoption; renewing agricultural education and training; promoting and strengthening farm-based organizations; improved coordination and management. These require about USD$67.5 million.

A National Seed Policy and Regulatory Framework was developed in Liberia in April 2012 to promote private sector participation in seed development, ensure quality seeds to farmers and oversee registration and certification of seeds. The seed policy encompasses various government activities meant to guide and manage the seed system, including public investment in seed trials, extension services, and seed trade policies. The regulation covers specific rules that limit and/or define the activities and behavior of individuals and companies. The policy outlines the process of varietal selection and development, multiplication and distribution of high quality and marketable seeds and planting materials for farmers and other stakeholders engaged in the seed value chain, both public and private. Considering that Liberia is a member of the Economic Commission of West African States (ECOWAS), and that it has signed a regional agreement (ECOWAP) aimed at facilitating cross-border trade in seeds, the seed policy will facilitate implementation of the regional harmonized ECOWAP seed laws and regulations at the national level, particularly seed quality control, certification and variety release (Republic of Liberia, 2012b). Still, there is need for a regional policy framework on seeds that would guide development of country seed policies and practice.

n) Niger

The Mechanism for Support and Advice (2011) aimed at segmenting advisory services: public support and advice service to 150 poorer municipalities; and specialized support and advice services (on payment basis) to sectors and profitable economic activities in 105 municipalities. However, its implementation has been hindered by lack of funding and lack of consultation of FOs.

7. MECHANISMS AND PRACTICES AFFECTING SMALL-HOLDER INCLUSION AND INNOVATION LINKAGES WITHIN AIS

As alluded to in Section 6.1, the FAAP sets forth key principles to promote inclusion of smallholders in national agricultural innovation systems. It may be expected that as African countries embark on implementation of the CAADP NAFSIPs, greater smallholder engagement will feature since the national CAADP roundtable processes ensured inclusion of this provision according to the FAAP principles. However, a review by FARA in 2012 on the extent to which tertiary agricultural education (TAE) issues were embedded in the NAFSIPs of CAADP post-compact countries revealed critical gaps and omissions that point to a not-very-diligent roundtable processes. Through TEAM-Africa, measures have since been put in place (e.g. the formation of CAADP Country Core Education Groups) to ensure sufficient inclusion of TAE issues in the NAFSIPs and programs. Similar arrangements, perhaps through country FBOs, would be warranted to take care of smallholder issues.

The level and mechanisms for involvement of local stakeholders in agricultural innovations varies in different countries. For example, several formal farmer organizations (FOs) exist in Tanzania and they organize and represent farmers in agricultural innovation. Due to unreliability of the national umbrella organization – the Tanzania Federation of Cooperatives, a new representative network of farmers groups MVIWATA emerged in 1993. This is an NGO that represents the interests of over 60,000 farming households. It participates in various national fora for the agricultural sector. Further, MVIWATA and its local networks are actively involved in agricultural R&D and work closely with different sources of market information and knowledge for innovation sources. It has established experience with farmer-to-farmer knowledge exchange for innovation and contracting of agricultural services. Besides MVIWATA, there are some commodity-specific FOs such as Tanganyika Coffee Growers Association and Association of Kilimanjaro Speciality Coffee Growers (AKSCG).

Still in Tanzania, there are active linkages between FOs and other actors in innovation. For instance, representatives of these FOs are board members of privatized coffee research bodies such as the TACRI. Many NGOs are also involved in farmer empowerment, group formation, adult education and technology transfer. Some area-based development programmes and NGO-supported projects have experimented with improving access to technology for poorer smallholders through farmer empowerment and targeted investments that aim to deliver public goods and address market failures, more so in drought-prone localities. In research and extension, farmers are members of the planning and decision-making fora. At national level, farmers are part of the National Agricultural Research Fund (NARF) board and steering committee members of donor-funded projects. At zonal level, two farmers are members of the 10-person Zonal Agricultural Executive Committees (ZAECs). Farmers through their FO representatives are also members of Zonal Technical Committees (ZTCs) and Zonal Agricultural Research Fund Management Teams (ZARFMTs). It appears that farmers are well represented in the boards and governance of policy, research and extension institutions at country level. This is also true for the three SROs (ASARECA, CCARDESA and CORAF/WECARD) and FARA. It is unclear to what extent higher agricultural institutes (e.g. universities) accept farmer representation in the boards.

However, farmer representatives who participate in priority setting in these boards lack capacity and may in some cases tend to represent stakes by virtue of the fact that government regional officers, or perhaps funding agencies, instead of farmers, influenced their selection. Further, there is no defined coordination mechanism for FO formation, operations and evolution and it is thus difficult to evaluate their impact on R&D decision-making processes. Formation of some FOs is externally driven without local initiative (most FOs are found in areas with a large concentration of donor-funded projects). This external drive often leads to unbalanced farmers' groups and unstable organizations after external assistance ends.

In Burkina Faso and Niger, collaboration between the State and FOs remains difficult. The FOs are either not consulted or, if invited to deliberations, their ideas are often overlooked in adopted strategies. Moreover, in both countries the change in the vision of what advisory services should be or can be is not

yet clearly discernible in the policy documents of their Ministries of Agriculture. In contrast, in Benin, a real change in approach is reflected in the policy documents. The documents propose a single point of contact for the farmer. This contact person is responsible for organizing the advice and summoning the expertise required as and when required by the farmer. In Benin, the Ministry of Agriculture and FOs collaborate and progress together. The FOs were consulted during the design of the White Paper Policy on advisory services, and FOs such as PROCOTON were actively in charge of the implementation. Country-specific institutional set-ups and political economy considerations may influence the apparent variation in the degree of farmer engagement in the national agricultural innovation systems.

The following farmer-centred regional investment needs and opportunities for innovations were identified in a study conducted by the Easy African Farmers' Federation (EAFF, 2012[42]):

- Regional Agroindustry - low value addition in the region's agricultural share of total GDP; poor national infrastructure in processing and storage; food deficit during the slack seasons, production waste during the surplus seasons; high rates of malnutrition; the EAFF member countries experience large postharvest losses, especially for perishable commodities such as fruits and vegetables, with post-harvest losses averaging between 35 -50% of total attainable production. For grains, such losses vary from 15 – 25%.
- Regional fertilizer, seed and other agricultural input plants - fertilizer consumption levels are still extremely low. Average fertilizer use per hectare in Sub-Saharan Africa has remained between 5 kg/ha and 10 kg/ha since 1990. This is less than 10% of the world average and far below the 50 kg/ha minimum target set by the Abuja Declaration by 2015. In the EAFF Region, the overall progress in the implementation of the Abuja Declaration is satisfactory, but there is still much room for improvement. High input (i.e., fertilizer and seed costs), land degradation/low and declining soil fertility, agricultural production in the EAFF region has not been performing adequately, thus plunging the populations into unprecedented food insecurity.
- Investment in training/capacity strengthening for farmers on sustainable agribusiness enterprises - agricultural training is critical if agriculture is to be modernized and developed on a sustainable basis; institutional capacity also plays a role in promoting agricultural productivity; the current low absorption of modern technology;
- Regional agricultural farmer institution – for policy analysis; statistics forecasting; input/output markets; joint procurement and distribution; risk mitigation
- Trans-border infrastructure (road, rail, electricity, etc) - inadequate regional road and railways infrastructure; high cost of transport (particularly the landlocked countries); regional political borders frequently separate food surplus production zones from the deficit markets they would normally serve. Regional cross-border trade can clearly contribute to improved regional food security, although this will require infrastructural investment and policy harmonization key trade corridors; high cost of electricity;
- Investment in climate-smart technologies that ensure efficient land and water management - increased cultivation of marginal lands; huge potential for irrigable land; over-dependence on rain-fed agriculture; poor water management and inefficient irrigation systems; climate change variability; the impact of climate change on cooperation between riparian countries of shared river basins e.g. the Nile.
- Regional food reserves - considerable amount of harvest lost during bumper harvest due to poor logistics post-harvest; frequent food aid especially during drought seasons; reducing vulnerability and/or exposure to future food security shocks; and transitioning from emergency food security responses to long-term development strategies.
- Regional Market Information System (MIS) – for increased profits; regional trade is an engine of growth in eastern African Counties; will help reduce transaction costs

To ensure farmer issues receive deserved priority in innovation systems, it is instructive to have farmer representatives or champions genuinely interested in articulating farmers' positions. To this end, modalities

[42] East African Farmers' Federation (2012). Supporting farmers in the implementation of CAADP. Workshop Report.

for farmer representation should be clearly embedded in strategic and policy documents. Such policies should also involve land tenure regimes that enable smallholders to invest in agriculture. As indicated in Appendix 4, national policies focused on smallholders and family farmers development are clearly articulated in the sector strategies for Rwanda, Tanzania, Malawi, Mozambique, Benin and Niger. Smallholders are also appreciably involved in defining research and innovation challenges and priorities in Rwanda, Tanzania and Benin. Land tenure regimes supportive of smallholders are present in Ethiopia, Rwanda, South Sudan, Zambia, Benin, Gambia and Liberia. In Tanzania, research grant systems that favour smallholder agenda are present through the Zonal Agricultural and Livestock Development Fund.

Further, power dynamics amongst actors, especially along value chains, often play against smallholder interests and exclude them from benefitting from innovation networks. This can take various forms including informational and hermeneutical power leverages by middlemen capitalizing on the low capacity of famers. As demonstrated in the case of the 'market spies' of Tanzania (Section 5.3.6), farmer groups have circumvented information asymmetries via ICT-based innovations through the agility of innovation brokers, in this case, MVIWATA. Based on this observation, it would appear that the successful inclusion of smallholders in agricultural innovations depends on having effective interfacing champions of farmer groups with 'ambidextrous capacity' for group alignment and adaptation. The development of such capacity would relate more to the five core capabilities of European Centre for Development Policy Management (Engel et al 2007)[43] rather than the discrete and static categorization capacity as represented in the FAO's Capacity Development Framework[44](Ekong, 2013)[45].

[43] Engel, Paul Niels Keijzer and Tony Land 2007. A balanced approach to monitoring and evaluating capacity and performance. A proposal for a framework. ECDPM Discussion Paper No. 58E

[44] http://www.fao.org/capacitydevelopment/the-three-dimensions-of-the-fao-capacity-development-framework/en/

[45] Ekong, J. (2013). Grasping Complexity – Assessing Capacity Development in Agricultural Innovation Systems. Keynote paper presented at a Side Event on 'Strengthening Capacities for Agricultural Science and Innovation: From Framework to Networks and Impacts' at the 6th Africa Agriculture Science Week, held 15 – 16 July 2013 in Accra, Ghana. Unpublished.

8. SPECIFIC COUNTRY NEEDS ON CAPACITY DEVELOPMENT FOR AGRICULTURAL INNOVATION

8.1 Enabling Environment

Appendix 5 summarizes the capacity development needs identified in some TAP target countries where information was available. On policy level or regulatory framework to promote inclusive agricultural innovation, the regulatory agencies in Rwanda such as the Rwanda Bureau of Standards (RBS) and the Rwanda Environment Management Agency (REMA) lack the technical capacity to define and enforce health and environment standards. Specifically, there is:

- shortage of technical and vocational skills needed to build and maintain water distribution networks
- lack of engineering and technical capacity to explore and drill underground water
- technical capacity to design and enforce effective food safety and food hygiene standards that do not deter the development of the food-processing industry
- lack of technical support programmes for vocational training centres that offer certificates and diplomas for water technicians

One response option would be to initiate/review courses in water management and engineering at the Kigali Institute of Science and Technology (KIST) the National University of Rwanda (NUR), and other local technical institutes.

8.2 organizational Capacity

The organizational capacity areas identified in the review include effective linkages among main actors and especially with smallholders, inappropriate training curricula, integration of smallholders needs in agricultural innovation, linkages with regional and international innovation organizations, and knowledge and information flows in support of innovation systems (Appendix 5).

In Benin, weak linkages between producers' unions, research centres and extension service providers were identified (Wennink and Heemskerk, 2006). This would be alleviated by enhancing collaboration and information sharing mechanisms between these actors as may be mediated by the producer organization (FUPRO) and government agencies.

In Rwanda, there are limited practical courses at universities and engineering schools due to lack of laboratory and workshop infrastructure. Information on value addition is poorly documented and the agencies responsible for producing technologies (Centre for Innovation and Technology Transfer – CITT, and Institute for Scientific Research and Technology – IRST) focus more on development of new technologies and less on transferring these to small and medium-sized enterprises. Furthermore, the products from CITT and IRST are not always efficient or affordable. Some suggested solutions entail:

- Establishment of practical production units that function as micro-entreprises for dairy and meat processing
- Alignment of technical and vocational courses to industry needs by preparing technical manuals in local languages that codify the in-house expertise of existing value-added enterprises
- Establishing a technology advisory service to help firms search, acquire and upgrade their technology
- Boosting technology transfer skills of CITT personnel by initiating specialized training courses in cost-benefit analysis, market value chains and business communication
- Providing incentives (e.g., better salary, promotion, learning opportunities) for CITT and IRST to focus on the transfer and distribution of appropriate technology, and on prototyping and production

The responsible actors involve Government of Rwanda, technical institutes, individual farmers and farmer groups.

Still in Rwanda, there appears to be a lack of capacity to capture, adapt and adopt low-cost agricultural technologies developed elsewhere. Suggested remedies include establishing an international outreach programme that would link CITT with global counterparts through staff exchanges, staff visits and seminars and a technology diffusion trust fund that would finance joint proposals by universities, private firms, research centres, and civil society organizations for technology sourcing, development or distribution projects.

8.3 Individual capacity

The needs identified include inadequate human capacity skills of main organizational actors. In Mozambique, for example, the total national agricultural FTE is 263. Over 50% of researchers at IIAM are under 40 years old of whom 9% PhD and 37% MSc, with less than 30% female researchers at degree level. There is no PhD program offered in local agricultural training institutions and only a few in-country MSc. Programs exist. Language limitation does not allow locals to pursue postgraduate training abroad and research centres have to co-share the limited staff with universities. Suggested remedies would include training of technicians, and researchers to MSc and PhD levels. To this end, partnership funding between universities and SIDA, World Bank, FAO are already on-going.

In Tanzania, a freeze on civil service hiring in 1992 until 2002 followed by massive retirement of many PhD holders led to high proportion of newly recruited less-qualified research staff. Further, there is no major training programme for government-based staff. Incentives to aid retention of highly qualified research staff and training of newly recruited young researchers to MSc and PhD levels are some recommended actions.

Niger has about 93 FTE researchers, i.e. 23 FTE researchers per million farmers. Only 7% of agricultural researchers are women. Support staff to researcher ratio is 4.1. About 24% of researchers have PhD degrees. High staff turnover in search for better payment elsewhere. About 30 to 50 researchers at PhD level should be recruited by 2025. AGRA and AfricaRice are currently funding PhD training for five INRAN staff at University of Ghana and UAM.

9. REGIONAL INITIATIVES ON CAPACITY DEVELOPMENT FOR AGRICULTURAL INNOVATION

9.1 Capacity Development for Agricultural Innovation in ASARECA

As shown in Appendix 6, the main capacity development service providers in the Eastern and Central Africa region have been the World Bank, FAO, IFAD, BMGF, CIDA, SIDA and Danish International Development Agency (DANIDA). Whereas some grants and loans have been extended to country governments directly, a lot has been used in support of organizations like the CGIAR centres, FARA and ASARECA. The CD initiatives in ASARECA can be grouped into regional or country-level interventions.

9.1.1 Country-level CD Initiatives:

Each ASARECA country under review has various CD initiatives supported by different donors/development partners. The IFAD supports the following specific CD activities in the respective countries:

- Comoros - national programme for sustainable human development.
- Ethiopia – agricultural marketing improvement, participatory small-scale irrigation development, community-based integrated natural resource management, pastoral community development, and rural financial intermediation.

- Rwanda – rural small and micro-enterprise development, community-based watershed management, rural incomes through exports.
- Tanzania – agricultural services support, value addition, and rural finance development.

In Ethiopia, the CD actors have adopted the five fundamental principles for making aid more effective, as outlined by Paris Declaration on Aid Effectiveness (2005), i.e., ownership, alignment, harmonization, results and mutual accountability. There are several initiatives supporting Ethiopia's Growth and transformation Plan. Such initiatives address especially household food security and the incomes of poor people, through the implementation of agriculture and livestock production and technologies support.

9.1.2 Regional Initiatives

9.1.2.1 Bill and Melinda Gates Foundation (BMGF)-funded Initiatives

- Great Lakes Cassava Initiative in Rwanda, Tanzania and Uganda (2007 – 2012). This is an initiative aimed at addressing the food security threat posed by cassava mosaic disease and cassava brown streak disease. The CRS is the main service provider and the key activities include building capacity among national agriculture R&D partners, strengthening farmer group development, and conducting multiplication and dissemination of planting materials.
- East African Dairy Development (EADD) project in Rwanda, Uganda, among others (2008 – 2017). The main service providers of this project are Heifer International, ILRI, Technoserve, African Breeders Service, and Total Cattle Management. The key CD activities include creating and expanding critical dairy market infrastructure for smallholder producers.
- Agribusiness Consortium 2013: this aims at establishing a consortium of African Business schools that develop Agribusiness Management training programmes that are backed with contextual research. Service providers are the Association of African Business Schools and Sokoine University. It provides business management and leadership skills to a wide range of stakeholders including development organizations, government agencies, farmer cooperatives, small and medium enterprise owners.
- Tropical Agriculture and Rural Environment Programme. The Earth Institute and the Council for Industrial and Scientific Research are the main service providers. Land managers and policy makers are provided with capacity to identify and tackle trade-offs between intensified food production and vital ecosystem services.

9.1.2.2 CIDA-funded Initiatives

- Agricultural Innovation in SSA, FARA Phase 3 (2009 – 2016). The World Bank is the main service provider that assembles a network of agricultural research experts to support African countries in the CAADP process to develop and implement their national agricultural strategies.
- Development of livestock and irrigation value chains for smallholders in Ethiopia. ILRI provides technical assistance, training and mentoring of government specialists with improved production and marketing skills.
- Land husbandry, water harvesting and hillside irrigation project. The World Bank builds capacity of agricultural organizations, entrepreneurs and local governments in Rwanda.

In majority of the indicated initiatives, capacity development is a minor component of a larger agricultural project and thus lacking in design and implementation rigor. The CD offers in Rwanda, for example, do not match the identified needs indicated in Section 8 under enabling environment, organizational capacity, and individual capacity. This apparent mismatch in demand and supply of capacity is an area for TAP action e.g. under the 'Marketplace' component. TAP must also advocate for stand-alone CD programmes to strengthen agricultural innovation systems.

9.2 Capacity Development for Agricultural Innovation in CCARDESA

9.2.1 Country-level Initiatives

The specific CD initiatives in CCARDESA countries are briefly discussed in this section. The identified CD initiatives are listed in Appendix 7 – 13. In Angola, USAID is one of the main donors and it focuses on the activation of the value chains - from production through processing to markets for inputs and output of crops such as bananas and coffee. As a component of a bean improvement program, USAID is funding the strengthening of institutional capacity for the development and dissemination of improved varieties of common beans (Appendix 7). In Lesotho, the Swiss Government is funding institutional strengthening to create investor-friendly business climate for fruit production and individual training of farmers to boost maize and bean seed production (Appendix 8). Under the MIRACLE Project on Agriculture and Nutrition, USAID is strengthening the capacity of stakeholders in agricultural production and also promoting improved policies in Malawi, Mozambique and Zambia. Germany, through BMZ, is also supporting the development of capacity to adapt to climate change through well-managed water use for aquaculture integrated with small-scale irrigation in Malawi, Mozambique and Zambia (Appendix 9). BMZ is also supporting improved policies regarding information services and analyses to address the global food security crisis in Malawi and Mozambique. AGRA is also supporting the training of human resource to improve smallholder agricultural productivity in Malawi.

In Mozambique, a triangular consortium of Brazil, China and UK are jointly supporting the strengthening of research capacity acquisition of materials/infrastructure and technical support. AGRA and the Millenium Challenge Fund are jointly supporting the development of financial management capacity of financial institutions targeting SMEs in Mozambique (Appendix 10). China is supporting the training of farmers in various technologies to encourage the transfer of mainly Chinese technologies to Mozambican farmers. Brazil and the EU are jointly supporting the strengthening of planning, coordination, monitoring and assessment of actions regarding agricultural research and dissemination of technologies (Appendix 10).

In Zambia, the University of Nebraska, Lincoln, has been involved in sorghum-based product development and entrepreneurship with local farmers. DfID has also supported the training of Zambian farmers on conservation agriculture, while the Chinese, through a locally situated Chinese Agricultural Technology Demonstration Centre, trains small-scale farmers in new agricultural technologies (Appendix 12)

9.2.2 Regional Initiatives

At the sub-regional level, the EU supported the improvement of professional skills in the SADC through training and information sharing. FARA's SCARDA program was also implemented in Lesotho and Zambia between 2007 and 2010 to strengthen the individual competencies of researchers and technicians through tailor-made courses and MSc training and institutional capabilities target organizations to manage agricultural research (Appendix 13). USAID's MIRACLE project was also regional in the sense that it was implemented in three different countries of Malawi, Mozambique and Zambia.

Both the country and regional projects in CCARDESA mainly targeted human and institutional components of capacity and, like in ASARECA, were embedded in wider agricultural projects, except SCARDA, which has been the only stand-alone capacity strengthening project ever implemented in Africa. Further, again with the exception of SCARDA in which a needs assessment was conducted prior to design and launch of the program, it is difficult to ascertain the degree to which the capacity development projects were matched to stakeholder capacity needs.

9.3 Capacity Development for Agricultural Innovation in CORAF/WECARD

Existing initiatives on capacity development in the CORAF/WECARD region target different aspects in various countries (Appendix 14 – 19). In Burkina Faso, the focus is on enhancing technical knowledge and decision making by (i) developing a national capacity for rural innovation (ii) building capacity of rural community (smallholder farmers) through technical assistance, trainings, (iii) integrated soil fertility management through assisting farmers in the country to gain better access to high-quality agro-inputs and increasing their awareness on soil fertility improvement, adopt a commercial approach to farming, reinforce coping mechanisms to hazards and risks of disasters by diversifying their sources of income (Appendix 14). The G20 countries that provide financial support to these initiatives are USA, France, Belgium, Switzerland and the UK, usually lasting about 2.7 years. In the Gambia, a mix of projects targeting individual and institutional/policy capacity development have been supported by various donors. The overall goal of the identified initiatives is to achieve sustainable agricultural development through innovation.

In addition to the G20 members who fund CD initiatives in Burkina Faso, Germany and other international agencies e.g., IFAD, FAO and IFDC support training efforts in the Gambia for about 2.2 years. The partnerships are mostly with local research organizations, NGO's, farmers associations and smallholder farmers (Appendix 15). The initiatives in Niger contribute to strengthening the capacities of national and local actors by providing training in different agricultural production-related activities. They are mainly funded by the USA, the Netherlands and World Bank, on average for 3.7 years (Appendix 16). As shown in Appendix 17, CD initiatives in Liberia involve different actors including international development agencies, NARIs, smallholder farmers, microfinance institutions, agro-dealers and trader associations. Finally, as indicated in Appendix 18, CD initiatives in Benin are mainly led by Universities with external sponsorship from Japanese and other organizations.

At the sub-regional level, projects targeting institutional and policy development have been supported by a number of donors notably AusAID, World Bank, DfID, BMGF and USAID (Appendix 18, 19, 20). At continental level, institutional strengthening projects include the Africa Soil Health Consortium (IFDC, BMGF and USAID), Integrated Striga Mangement in Africa (BMGF), RAILS/DONATA (FARA, AfDB), and Improved Maize for African Soils Project (BMGF). As shown in Appendix 21, projects that had individual capacity strengthening components include SABIMA (FARA, SFSA), Effective Grain Storage (SDC), SCARDA (FARA, DfID), UniBRAIN (FARA, Danida), PSTAD/DONATA (FARA, AfDB), and SASACID (SIDA, AfDB).

10. DEMAND, GAP ANALYSIS AND IDENTIFIED CAPACITY

A structured questionnaire (Appendix 22) was mailed to at least seven respondents per country each representing various stakeholder groups, viz.: policy, research, higher education, extension, NGO, FBO and CSO. The questionnaire had three parts. Part 1 solicited responses on 'Challenges of Current NAIS' regarding public policy, private sector, farming sector, society/education, NGOs and CSOs. Part 2 was concerned with 'Innovation Challenges and Actors Involved' and responses were solicited on environmental, agricultural, economic and social challenges; importance of various stakeholder groups in bring about innovations; suggested innovations (technological and institutional) to address the identified challenges; tools to encourage PPPs; and social inclusion issues (women, youth and smallholders). Part 3 requested for perceptions on personal experiences of the NAIS in one's own field.

Respondents were asked to choose from a menu of options for each of the questions and rated their perceptions on a scale of 1 to 4, where 1 represented 'not important at all' and 4 represented 'very important'. The total number of expected responses was 105, seven from each of the 15 countries. In ASARECA, the response rates by country were Ethiopia – 14%; Rwanda – 71%; Tanzania – 29%; Comoros and South Sudan – 0%; Uganda – 57%; and Kenya – 14%. In CCRDESA, Angola returned 14%; Lesotho – 100%; and Zambia - 71%. In CORAF/WECARD, the respective response rates were Burkina Faso – 43% and Niger – 100%. The overall response rate was 31%. A summary of survey responses disaggregated by stakeholder groups for each of the sub-regions is presented in Section 2. The graphical representation of responses below is based on the percentage of respondents who rated the issue either a 3 or a 4 i.e. 'important' to 'very important'.

10.1 Challenges in National Agricultural Innovation Systems

10.1.1 Public policy

As shown in Fig. 5, respondents in the ASARECA sub-region identified the four most important challenges to the NAIS in their respective countries as lack of incentives to innovate, lack of clear innovation strategy in public policy, and insufficient coordination within government agencies.

In CORAF/WECARD, the most important four challenges were insufficient coordination within government agencies, lack of policy dialogue with other actors, lack of appropriate legal framework to support innovation in public sector, lack of clear innovation strategy in public policy and exclusion of local stakeholders from the policy dialogue processes.

In CCARDESA, the stakeholders identified lack of clear innovation strategy in public policy, lack of policy dialogue with other actors, and low quality of entrepreneurial infrastructure as of equal and foremost importance in public policy. Lack of incentives and exclusion of local stakeholders were equally rated as the next important set of challenges affecting public policy. Regulations that make innovation costly was least regarded as a challenge to public policy in all the three sub-regions.

Overall, exclusion of local stakeholders and lack of clear national innovation strategy appear to cut across all the three sub-regions as the most important challenges affecting public policy. Exclusion of stakeholders in the design of innovations perhaps imply a persistence of the linear approach to technology development and that the national agricultural innovation system as a construct for sector programming has not taken root in all the sub-regions. Lack of incentives to innovate, lack of policy dialogue with other actors, and lack of appropriate legal framework to support innovation in the public sector were identified as the next important challenges to public policy across the sub-regions.

As discussed in Section 6, almost all the 15 countries have embarked on the CAADP country roundtable process. As a framework, CAADP seeks to inspire institutional and policy transformation in order to meet the twin goals of securing investments and growth in the agricultural sector. Unfortunately, the expected

pro-innovation policies, as corroborated in this brief survey, have lagged even in countries well advanced in the CAADP process.

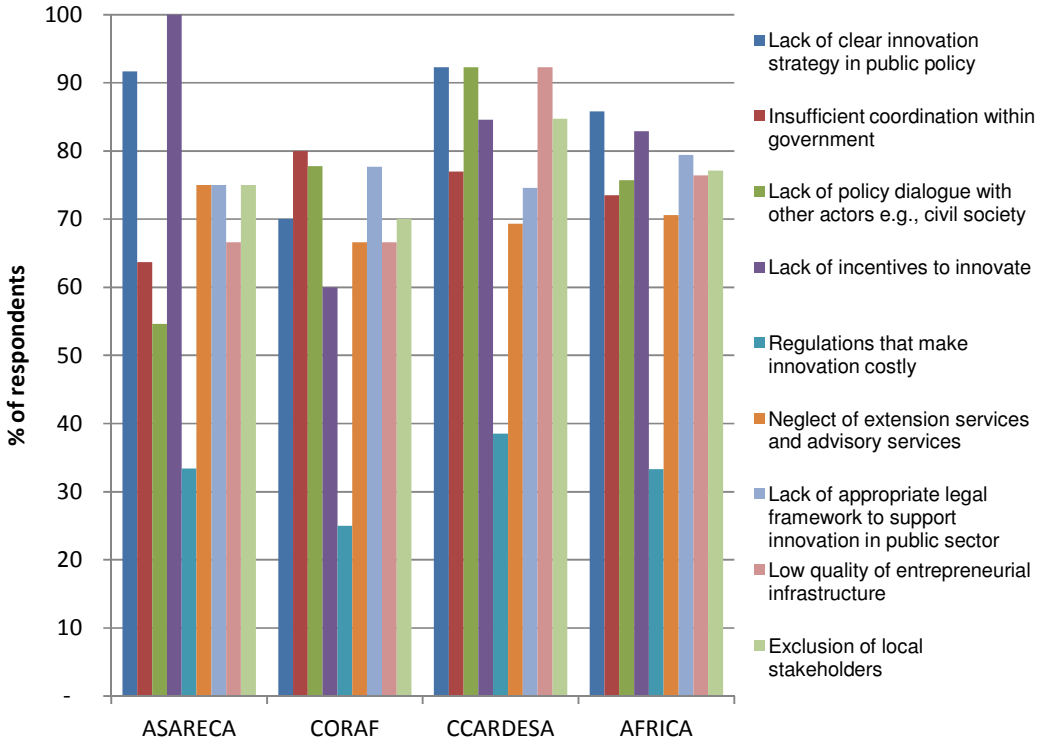

Figure 5: Importance of challenges in the NAIS regarding public policy

A few countries though have elaborated specific biotechnology/biosafety, IPR, extension, ICT and seed policies. In other countries, modicum policy statements are embedded in national development or agricultural strategy documents. However, even in countries where a number of pro-innovation policies exist, there may be issues to do with alignment and mode of implementation. Theoretical models for policy implementation include top-down, bottom-up, or principal-agent approach (Buse et al., 2005)[46]. In innovation systems, at least the bottom-up approach is desirable, where the government's role is seen as that of a facilitator. The reality in many countries however is that even the policy development process is exclusive and the top-down implementation mode is prevalent. This is an entry point for TAP under the Policy Dialogue component.

10.1.2 Private sector

Stakeholder perceptions on the challenges to the NAIS regarding private sector are shown in Figure 6. In ASARECA, lack of private sector investment in agriculture, distrust of PPP in R&D, lack of responsiveness to needs of small producers, and difficulties to access technology without IP protection were the main challenges to private sector engagement in the NAIS. In CORAF/WECARD, majority of stakeholder responses indicated lack of private sector investment in agriculture, domestic private sector decoupled from the NAIS, distrust of PPP in R&D, and difficulties to access proprietary technology as the main challenges. Stakeholders surveyed in CCARDESA identified distrust in PPP for R&D, lack of private sector investment in agriculture, domestic private sector decoupled from the NAIS, lack of responsiveness to needs of small producers, and difficulties to access technology without IP protection.

[46] Buse K, Mays N, Walt G (2005). Making Health Policy. Understanding Public Health Series Open University Press.

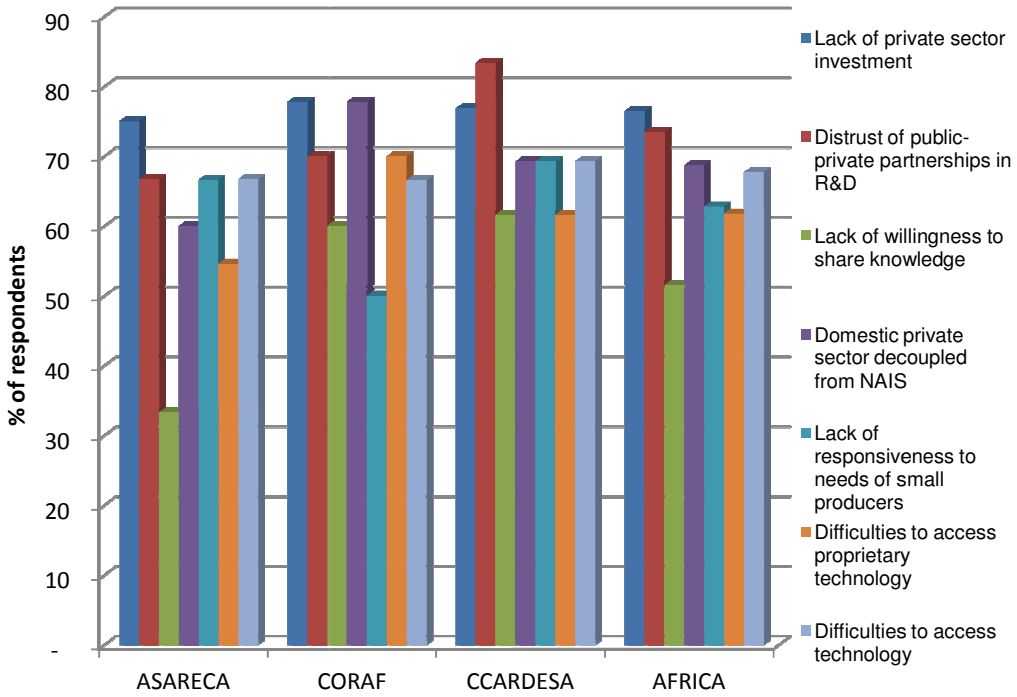

Figure 6: Challenges in the NAIS regarding private sector

Thus, majority of respondents from the three SROs roundly identified lack of private sector participation in the NAIS as the main concern. The literature review in Section 5.1.6 attributed the lack of private sector participation in the NAIS chiefly to certain factors that rendered the environment inconducive to business such as policies misaligned with stakeholder expectations, lack of incentives (e.g. tax regimes, physical infrastructure), and high risks and costs of doing business. In addition, it was suggested in earlier sections of this report that clear and formalized instruments of engagement could help alleviate the seeming distrust in PPP. In agricultural financing by private players, risk minimization through index insurance and Guarantee Funds has proved worthwhile across Africa. However, the issue of proprietary research and IPR as a barrier to private sector engagement in the NAIS still needs concrete resolution in a number of countries.

10.1.3 Farming sector

In all the three sub-regions, majority of the stakeholders regarded lack of financial services, lack of market access and lack of access to technologies as the main factors contributing to low innovation adoption rates amongst farmers. As opposed to ASARECA and CORAF/WECARD where it was the least important, lack of effective extension services was indicated as the highest determinant of technology adoption rates in the CCARDESA sub-region. Lack of recognition of grassroots or farmers' role in innovation contributed highest to low integration of farmers in CCARDESA and least in CORAF/WECARD, perhaps indicating the differing extents to which farmer-based organizations are actively promoting the interests of their members in the national innovation processes (Figure 7). In Section 5.1.5, it was also indicated that farmer-based organizations did not actively engage in determining research and extension priorities. Lack of recognition of farmers' role in innovations may be both a perception issue (on the part of the other stakeholders) and an advocacy failure on the part of the farmer representatives. Advocating for farmers' rights seems plagued by lack of capacity for demand articulation by farmer representatives and poor representation of farmer groups in national policy processes.

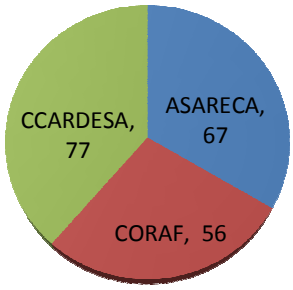

Figure 7: Lack of recognition of farmers' innovative potential

In all the three sub-regions, universities were the least responsive to farmers' needs in their innovative efforts followed by public research institutes. Accordingly, the respondents in three sub-regions also identified low rates of technology or knowledge exchange between universities and practitioners as the most important challenge to the NAIS. Stakeholders in all the sub-regions identified civil society groups as the most responsive to farmers' needs. In CCARDESA, low rates of technology or knowledge exchange between public extension and end-users highly contributed to low farmer integration in the NAIS, indicating an ineffective extension system in the sub-region. It appears that farmer inclusion in innovation processes is nominal, and unidirectional knowledge flows from researchers to end-users persists. In a situation where governments are not effective brokers, CSOs (being most responsive to farmers' needs) can intermediate between researchers and farmers to ensure demand-led innovations. The role of TAP may be to strengthen CSOs and NGOs actions in this regard.

10.1.4 Society/Education, Civil Society, NGOs and CSOs

Lack of infrastructure necessary to integrate rural regions into a system of agricultural innovation contributed highest to impeding the society or educational sector participation in the NAIS in three sub-regions. Scepticism towards innovation-driven entrepreneurs was the least constraint to society or educational sector participation in the NAIS. As shown in Figure 8, majority of stakeholders in all the three sub-regions felt that insufficient support to farmers' innovation followed by different priorities of local and global NGOs were the most important factors hindering participation of civil society/NGOs/CSOs in the NAIS.

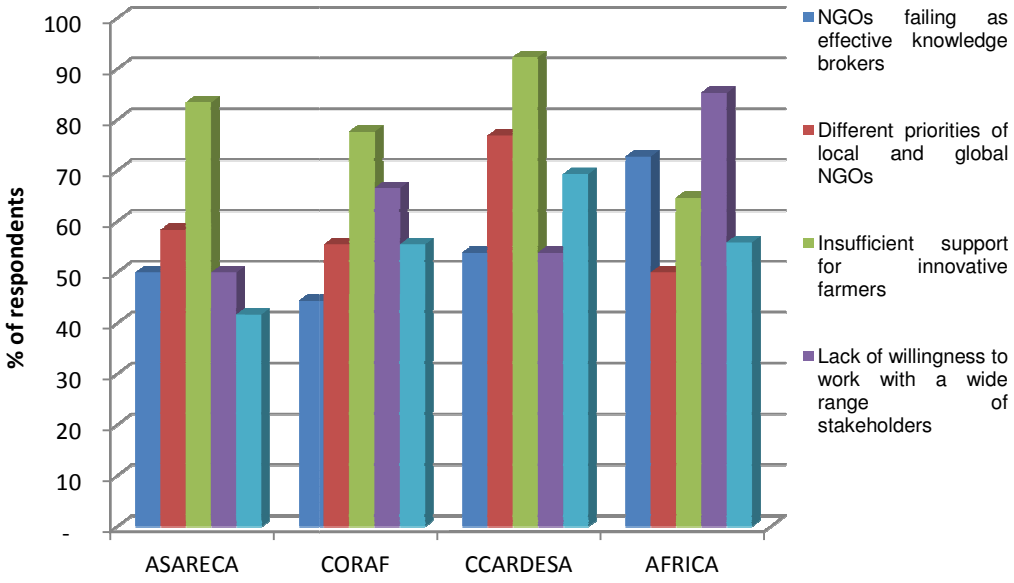

Figure 8: Challenges in the NAIS regarding NGOs and CSOs

The NGO domain, important as it may seem, is fraught with operational anomalies and governments in many countries treat them with suspicion. The survey respondents seem to fault them on three major accounts: ineffective knowledge brokerage, insufficient support to innovative farmers and exclusive behaviour. This may suggest that NGOs and CSOs serve the priorities of their benefactors at the expense of farmers. Whilst competition is healthy, the indicated underperformance and rivalry between local and foreign NGOs point to an operational landscape that lacks governance and regulation, perhaps due to a policy void.

10.2 Innovation challenges and actors involved

This section reports on the priority areas for agricultural innovations, relative innovativeness of stakeholders, innovations to address challenges, tools for PPPs, and social inclusion issues as perceived by the survey respondents in the three sub-regions.

10.2.1 Priorities for innovations

Stakeholders in the three SSA sub-regions consulted over the areas in which they thought agricultural innovations would be highly needed to address environmental challenges prioritized water and soil management in both ASARECA and CCARDESA, and soil management and climate change adaptation in CORAF/WECARD (Figure 9). Stakeholders in all the three sub-regions gave first priority to soil management innovations and least attention to climate change mitigation.

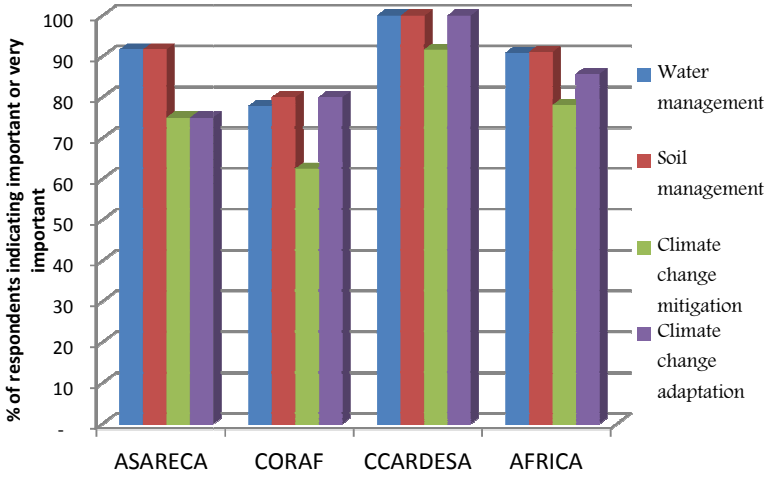

Figure 9: Stakeholder views on priority innovation areas addressing environmental challenges

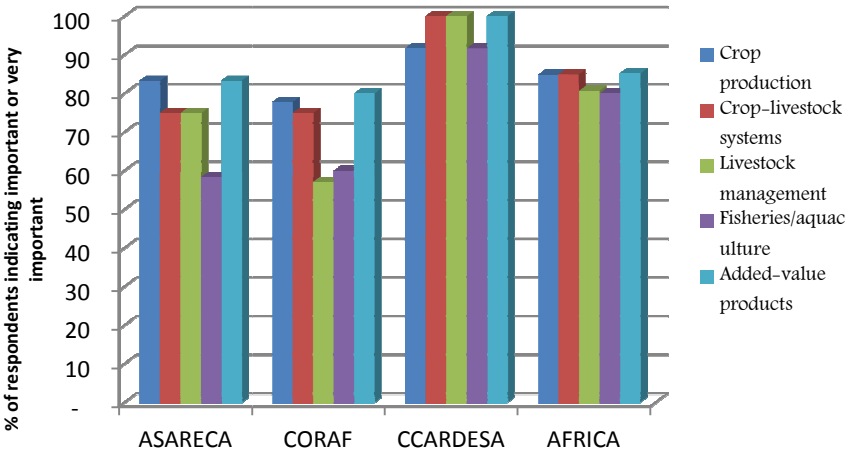

Figure 10: Stakeholder views on priority innovation areas addressing production system challenges

Further, stakeholders in all the three sub-regions specified value added processing of produce as foremost priority area for innovations on production systems (Figure 10). Innovations in crop production systems were rated second in both ASARECA and CORAF/WECARD, while CCARDESA stakeholders identified livestock and crop-livestock systems as second priority areas. The least rated options were fisheries and aquaculture in ASARECA and CCARDESA and livestock management in CORAF/WECARD.

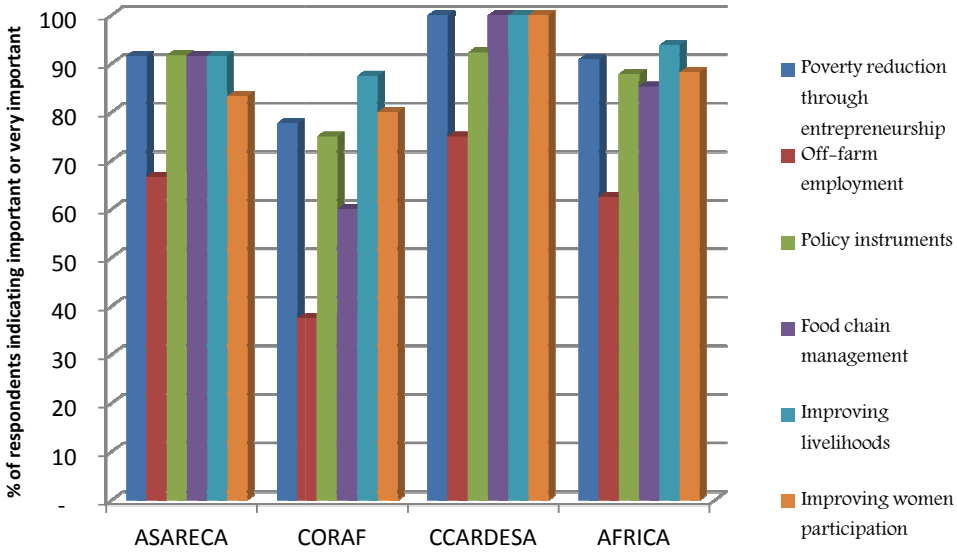

Figure 11: Stakeholder views on priority innovation areas to address economic and social challenges

As shown in Figure 11, stakeholders in ASARECA sub-region deemed innovations in poverty reduction through entrepreneurship, developing policy instruments to facilitate innovation, food chain management, and improving the livelihood of small producers of equal and foremost priority to address economic and social challenges. In CORAF/WECARD, innovations to improve the livelihood of small producers were of highest priority, followed by improving the participation of women and then poverty reduction through entrepreneurship. In CCARDESA, the stakeholders rated poverty reduction through entrepreneurship, food chain management, improving the livelihood of small producers, and improving the participation of women in the rural economy of equal and foremost priority. The overall scenario for areas that require priority consideration for innovations to alleviate socio-economic challenges in the continent is, in order of decreasing importance, improving livelihoods of small producers, poverty reduction through entrepreneurships, improving the participation of women, and policy instruments. Stakeholders from three sub-regions roundly considered innovations in off-farm employment to be of least effect in addressing economic and social challenges.

10.2.2 Relative importance of stakeholders in innovations

In the ASARECA sub-region, over 70% of stakeholders interviewed in this study indicated that universities and private advisory, extension and information brokers play the most important role in bringing about innovations. Public advisory services and NARIs came second, while farmers and NGOs were ranked third by majority of the respondents (Figure 12). Private and public advisory services and NARIs appeared to be the most important contributors to agricultural innovations both in CORAF/WECARD and CCARDESA sub-regions (Figures 13 and 14, respectively). Universities were placed second by the majority of the respondents, while NGOs and donors were ranked third by respondents from the CORAF/WECARD sub-region. In the CCARDESA sub-region, NARIs and universities came in second and international research institutes and NGOs were ranked third (Fig. 14). It is instructive to note that in all the three sub-regions, farmers and farmer organizations still play a passive role in the national innovation enterprise.

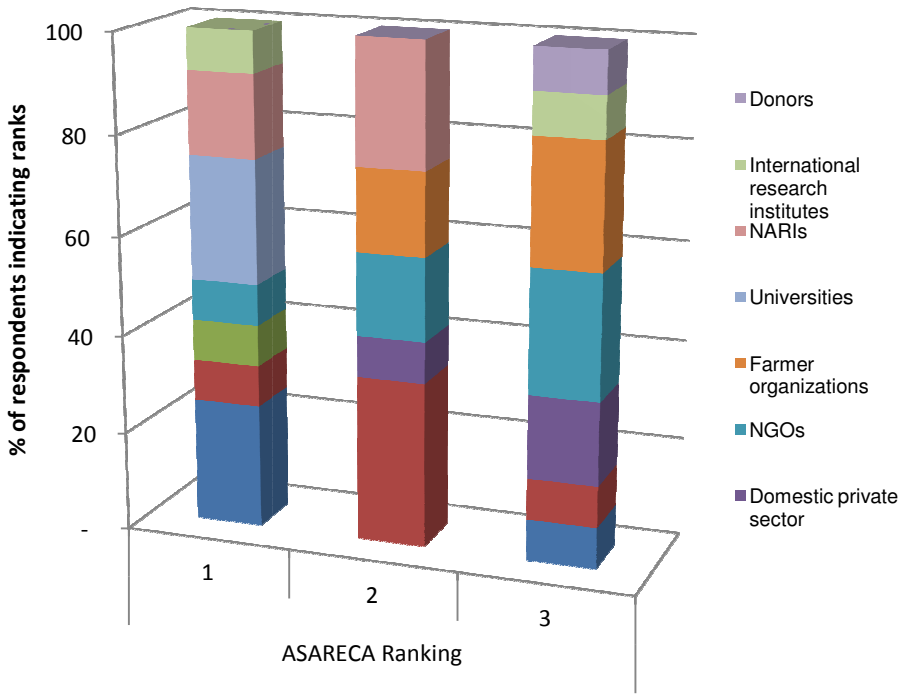

Figure 12: Ranked stakeholder contribution to agricultural innovations in the ASARECA sub-region

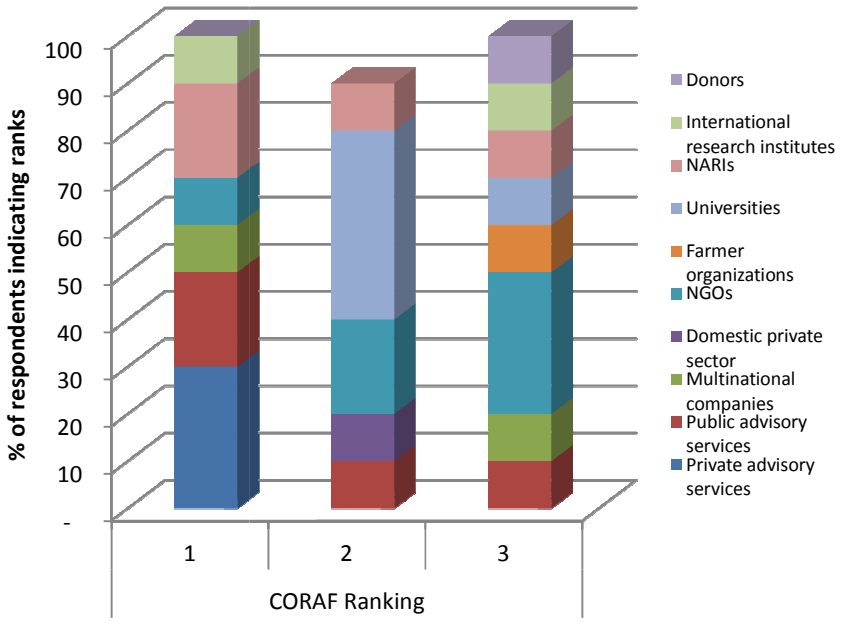

Figure 13: Ranked stakeholder contribution to agricultural innovations in the CORAF/WECARD sub-region

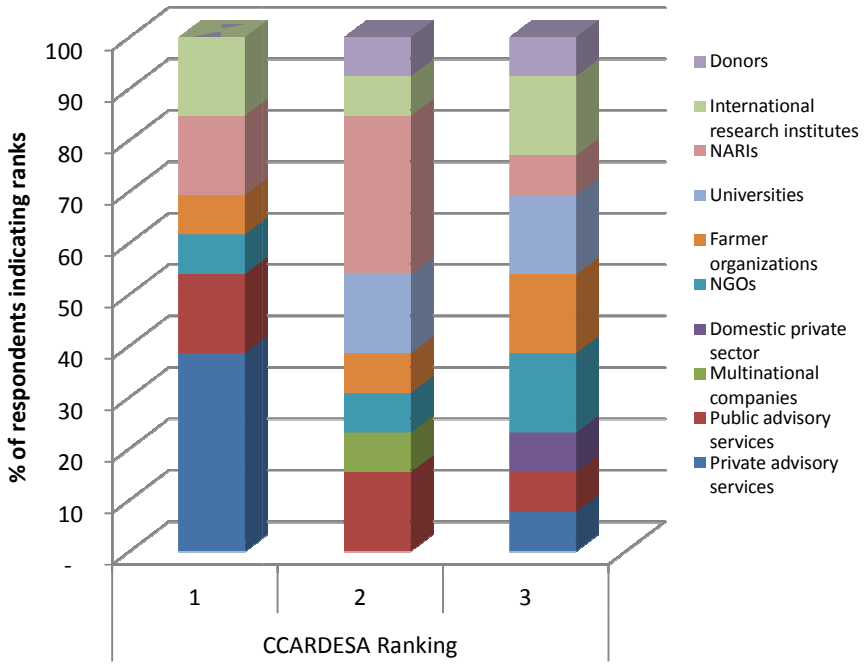

Figure 14: Ranked stakeholder contribution to agricultural innovations in the CCARDESA sub-region

10.2.3 Types of innovations to address the challenges

10.2.3.1 Technological innovations to address challenges

In all the sub-regions, the majority of stakeholders perceived that the most effective way to address environmental challenges such as soil and water management and climate change adaptation and mitigation was through innovations in agro-ecological techniques and practices involving conservation agriculture, agroforestry and integrated pest management (Figure 15). This was followed by grassroots innovations at farmer level e.g. rain harvesting techniques. The least number of stakeholders regarded platform technologies with low-cost user-friendly products to hold promise for addressing environmental challenges. On the other hand, platform technologies followed by grassroots innovations held the greatest promise to tackle economic problems across the three sub-regions. In addressing social concerns, the stakeholders were less enthusiastic in the technological innovation options proposed by the survey questionnaire and only a few rated platform technologies as the means to addressing them across the three sub-regions. In CORAF/WECARD and CCARDESA, a few stakeholders also rated grassroots innovations and agro-ecological techniques as possible solutions to social problems (Figure 15).

As shown in Figure 16, innovations in solar technology and biotechnology were identified by the majority of stakeholders in ASARECA to have the best bet in tackling environmental challenges. For economic challenges, ICT and biotechnology based innovations offered the greatest promise for solutions. The ASARECA stakeholders exclusively identified ICT-based innovations to remedy social challenges. Already ICT-based innovations are offering pro-poor solutions in rural finance and financial transactions (MPesa in Kenya, Uganda, Rwanda, South Sudan and Tanzania), market access (market spies of Tanzania), and precision agriculture (satellite-based weather predictions relayed via mobile phones in Kenya) in the sub-region. In both CORAF/WECARD and CCARDESA, stakeholders equally regarded innovations in solar technologies and biotechnology as most suitable for addressing environmental challenges. As in ASARECA, the stakeholders in the two sub-regions also identified mainly ICT-based innovations as most appropriate to address socio-economic problems (Figure 16). Overall, ICT-based was largely proposed to address socio-economic problems, while biotechnology and solar technologies were prescribed for environmental challenges.

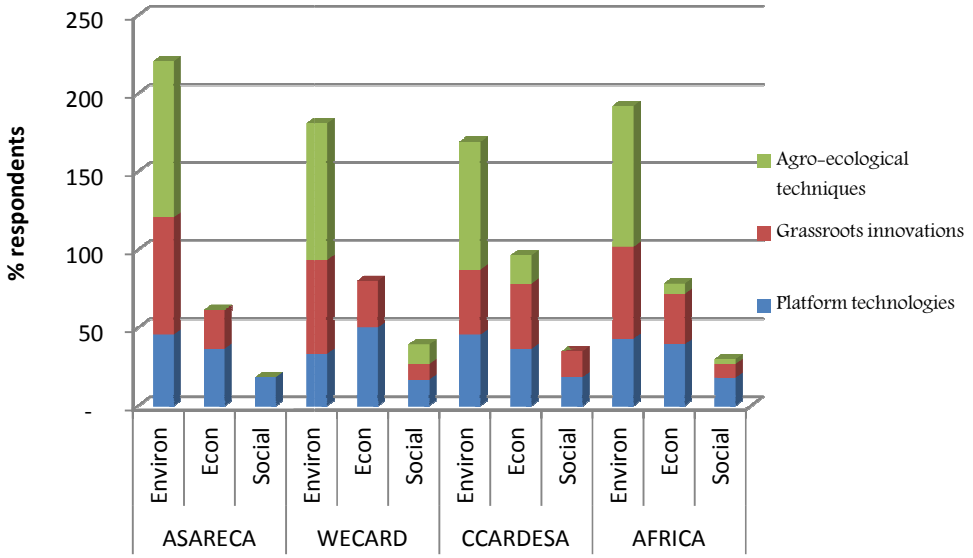

Figure 15: Technological innovations to address environmental and socio-economic challenges

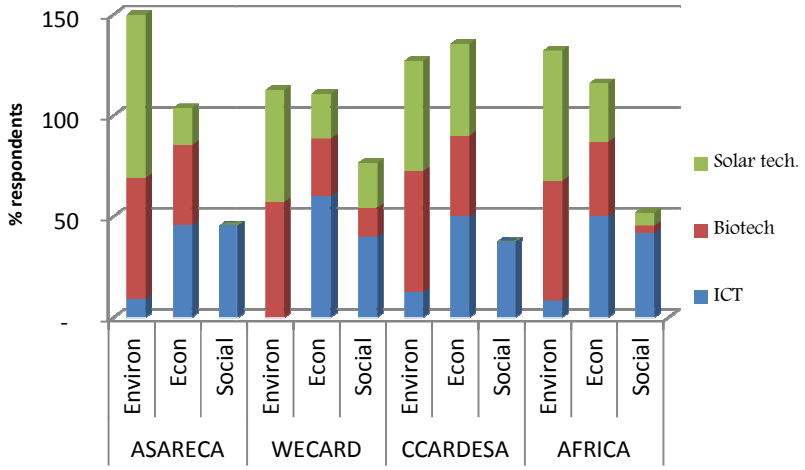

Figure 16: Types of platform technologies to address challenges

10.2.3.2 Institutional/management innovations to address challenges

From the low response rates shown in Figure 17, both ASARECA and CCARDESA stakeholders were apparently not fully convinced that the options for institutional and management innovations suggested by the questionnaire were suitable in addressing environmental problems. However, it was quite clear that stakeholders from the two sub-regions regarded market reforms as a viable means to solving economic problems. All the three regions indicated that reform of public extension system would also address, albeit to a lesser degree, economic problems. Unlike ASARECA and CCARDESA, respondents from the CORAF/WECARD sub-region were more positive on the utility of market and public extension reforms in addressing environmental issues. While education system and public extension reforms were gauged suitable for tackling social challenges in ASARECA and CCARDESA, the CORAF/WECARD stakeholders indicated that the same challenges would be better solved by market and education system reforms.

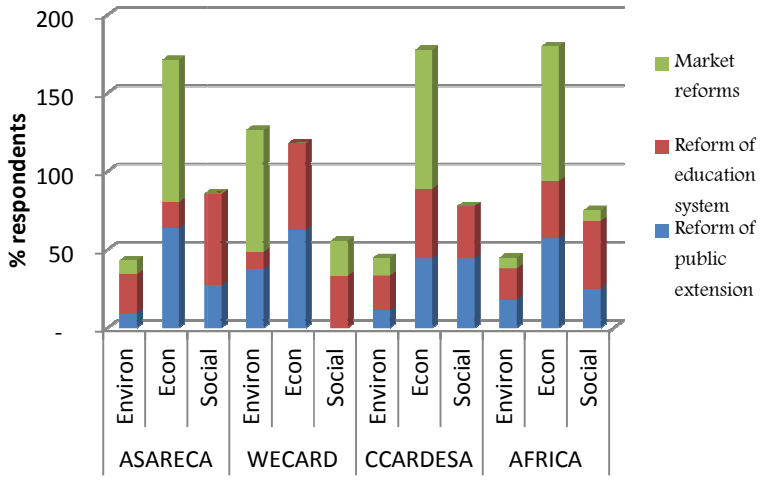

Figure 17: Institutional and management innovations to address challenges

On innovations in government policy instruments, business mentoring and microfinance were regarded as best bet innovation areas to address economic challenges in ASARECA and CCARDESA, and to a lesser degree in CORAF/WECARD. Stakeholders from all the three sub-regions seemingly did not regard policies on technology and extension services as suitable for addressing environmental and social concerns (Figure 18).

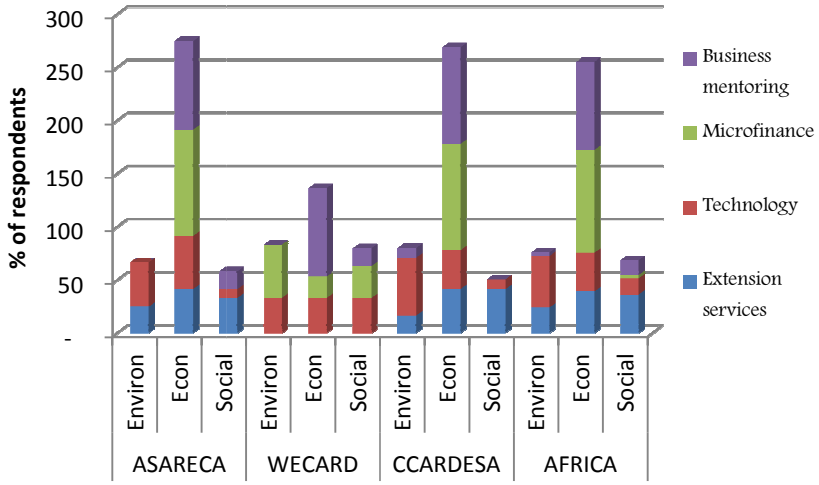

Figure 18: Government policies that enable provision of services to address challenges

10.2.4 Tools for public-private partnerships

As shown in Figure 19, respondents in all regions preferred provision of government incentives such as tax credits, matching grants, and joint-cooperation platforms to foster PPPs in innovations. The need for patent pooling and e-licensing platforms were more popular in CCARDESA, while national marketing boards were favourably considered in CORAF/WECARD.

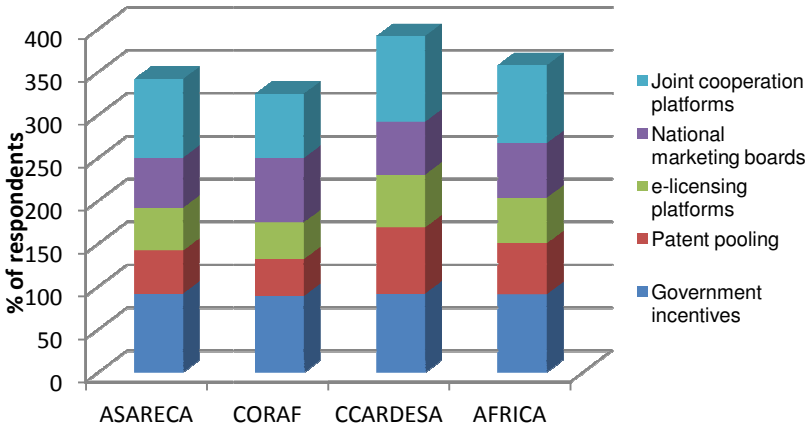

Figure 19: Importance of PPP tools in various sub-regions

10.2.5 Incorporation of women, youth and small-scale producer needs in the NAIS

The level of incorporation of grassroots stakeholders' needs in agricultural innovation processes is relatively low in Africa. For instance, less than 50% of interviewed stakeholders across the three sub-regions considered that women's needs were either fairly or completely included in the NAIS agenda. The gender inequality was even more pronounced in CORAF/WECARD, where only about 30% of respondents indicated that women's needs were either fairly or completely included in the NAIS agenda (Figure 20). This is perhaps attributable to inherent differences in socio-cultural settings e.g. religious customs that denigrate women status between the regions.

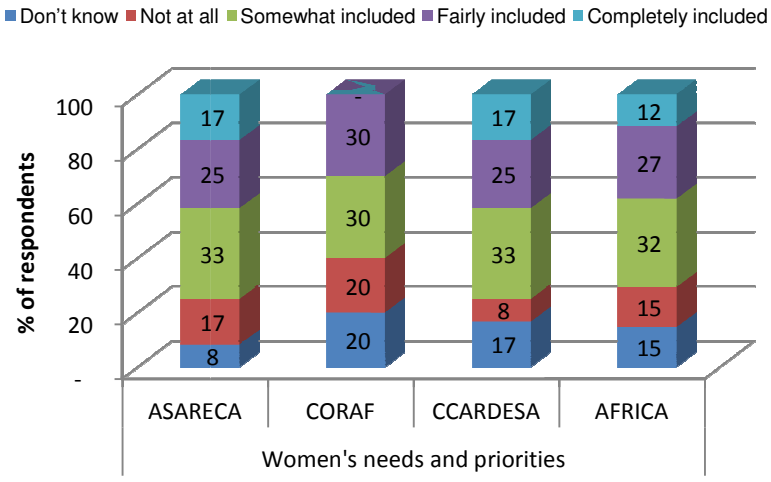

Figure 20: Degree of inclusion of women's needs in the NAIS agenda

As shown in Figure 21, youth needs and priorities fared no better than that of women with less than 50% of respondents from all the sub-regions indicating that they were fairly or completely included in the agenda of the NAIS. Respondents from CORAF/WECARD perceived that the needs and priorities of small-scale producers were fairly included in the NAIS agenda. In ASARECA and CCARDESA, the situation was less optimistic with 33% and 46% of respondents, respectively, indicating that the small-scale producers' needs were either fairly or completely included in the NAIS agenda (Figure 22).

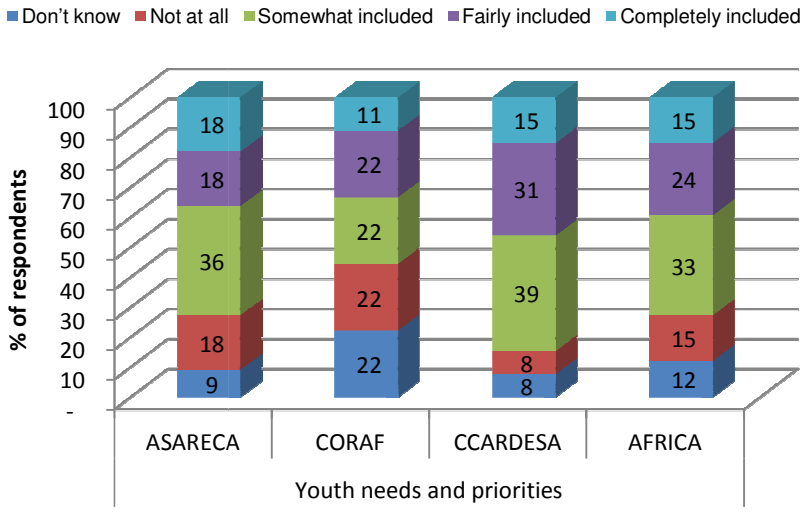

Figure 21: Degree of inclusion of youth needs in the NAIS agenda

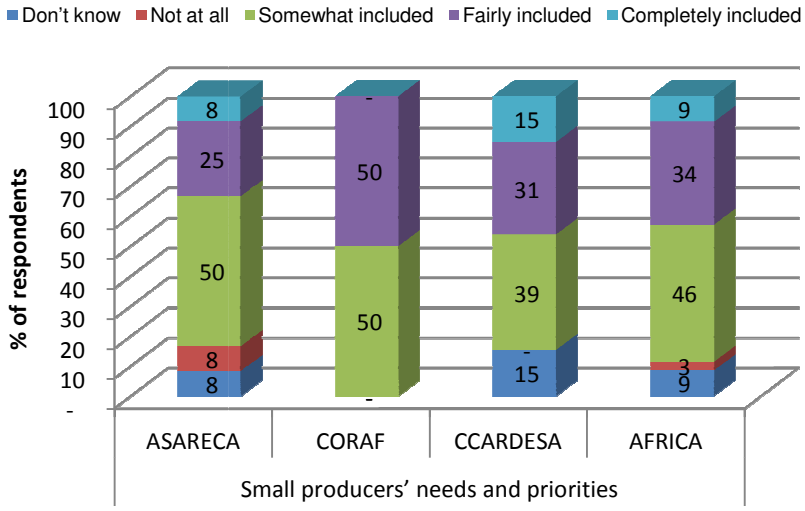

Figure 22: Degree of inclusion of small-scale producers' needs in the NAIS agenda

Special interest groups to promote women, youth and small producers' interest already exist at national and regional levels. For example, YPARD is a global initiative advocating for youth affairs in agriculture. The African YPARD coordination is under FARA and there are country YPARD representatives in majority of African countries. Similarly, the Pan African Farmers' Organization (PAFO) is an active stakeholder of FARA with sub-regional and national constituents all over Africa. Most agricultural sector organizations have resident gender equality specialists. It is incumbent upon these special interest organizations and departments to advocate for inclusion of their interests in national and regional agricultural sector policies and innovation strategies. The survey respondents suggested review of laws to mainstream gender in agricultural innovations, security of tenure rights in land for youth and women, and innovation exhibitions as possible ways of strengthening participation in innovations by women, youth and smallholders, especially those at grassroots level.

From the above account, the challenges that would require capacity development interventions are as follows:

- Developing human and institutional capacities in soil and water management, climate-smart agriculture and adaptation strategies, value added processing, and crop-livestock production systems
- Strengthening farmer role in the national agricultural innovation systems

- Expanding ICT infrastructure and formulating ICT, business mentoring, microfinance, and social inclusion policies and strategies

10.3 Practical experience of the NAIS by stakeholders

Stakeholders from a variety of backgrounds in the agricultural sector identified the key innovations in their respective fields over the last five years as shown in Table 3. In ASARECA, innovations were mainly in the areas of value-added commodity products and market access (i.e. linking farmers with warehouse receipt systems and improving awareness on sanitary and phytosanitary standards). In CORAF/WECARD, key innovations were in the areas of irrigation, natural resources management and new plant varieties. Stakeholder respondents from CCARDESA indicated innovations in the areas of new plant varieties, inclusive financing models, conservation agriculture, value addition, input technologies, and water use.

The major challenges to innovations in the three sub-regions can be broadly classified as (Table 4):

a) *resource endowments* (access to innovation finance from financial institutions, high cost of new technology and equipment, lack of farmer training centres for distribution of e-learning materials in remote areas, and lack of communication infrastructure);
b) *attitudes and mindsets* (inadequate participation in innovation meetings, reluctance by farmers to use warehouse receipt system, negative cultural values towards new varieties, application of new technologies if tedious or laborious);
c) *environmental* (desertification and climate change); and
d) *access to markets* for value added products.

These call for various remedial interventions, for example, policy and institutional innovations to facilitate access to innovation finance and markets, capacity development to change attitudes and mindsets, and technical innovations to adapt to effects of climate change.

As indicated in Table 4, the opportunities that motivated innovations identified in the last five years include abundant natural resources, collaborative linkages, conducive investment policies, new markets for innovative products, innovation capacity, and willingness to adopt innovative extension pathways such as e-extension.

Table 4: Key innovations, challenges and opportunities in the last five years

Issue	ASARECA	CORAF/WECARD	CCARDESA
Innovations	• Review meetings on innovation awareness • Banana product development and diversification • Linking farmers with warehouse receipt systems • Improved awareness on Sanitary and Phytosanitary standards	• Irrigation skills • New plant varieties • Nature rehabilitation • Transformation of aquatic plants	• Drought tolerant maize and beans varieties • Inclusive financing models • Conservation agriculture • Fruit processing • New herbicides • Better water utilization techniques
Challenges	• Unwillingness by financial institutions to lend money for innovations • Inadequate participation in innovation meetings • Reluctance by farmers to use warehouse receipt system • Lack of farmer training centres for distribution of e-learning materials in remote areas	• Lack of communication infrastructure • Desertification • Language barriers	• climate change • negative cultural values towards new varieties • high cost of new technology and equipment • lack of markets for value added horticulture products • application of new technologies is tedious/laborious • poor institutionalization of the technologies
Opportunities	• Abundant natural resources • Friendly investment policies • Many stakeholders interested in e-learning channels for farm extension	• Diverse food preferences • Natural resource base	• Collaboration with international organizations • Skilled staff

Majority of stakeholder respondents in CORAF/WECARD indicated that the innovations over the last five years very adequately benefited from a coherent NAIS, while innovations identified in ASARECA and

CCARDESA adequately benefited from the NAIS (Figure 23). However, quite a significant proportion of respondents from CCARDESA (about 25%) did not know as to whether the innovations had indeed benefited from the collective action of the NAIS.

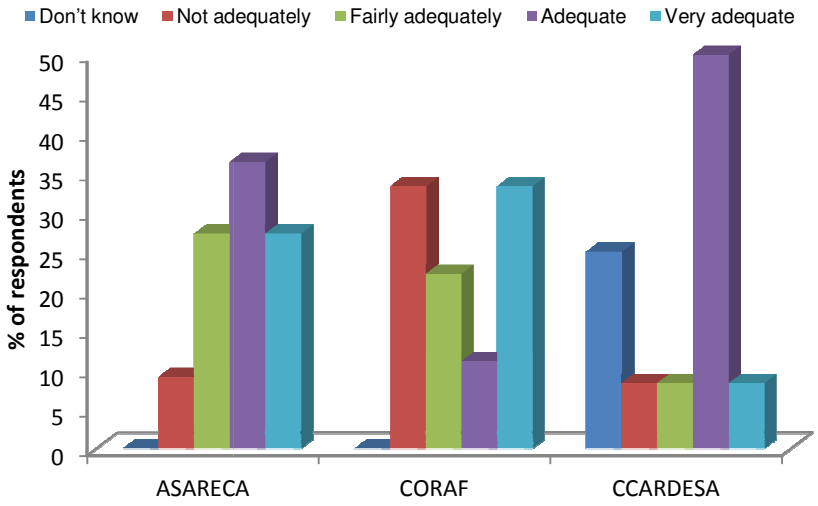

Figure 23: Stakeholders' perceptions on benefits from coherent NAIS

Perceived benefits accruing from the innovations as identified by stakeholder respondents are shown in Figure 24. Innovations in ASARECA predominantly contributed to increased productivity followed by increased income (perhaps from higher yields and income from surplus sales), improved risk management, and higher quality of life. The least benefits indicated for ASARECA innovations was improved health, which would appear rather contradictory to the higher quality of life registered by the respondents. In both CORAF/WECARD and CCARDESA, the patterns of the most important benefits from innovations were reminiscent of those for ASARECA. However, the least regarded benefit was better access to institutions for CORAF/WECARD and improved health for CCARDESA.

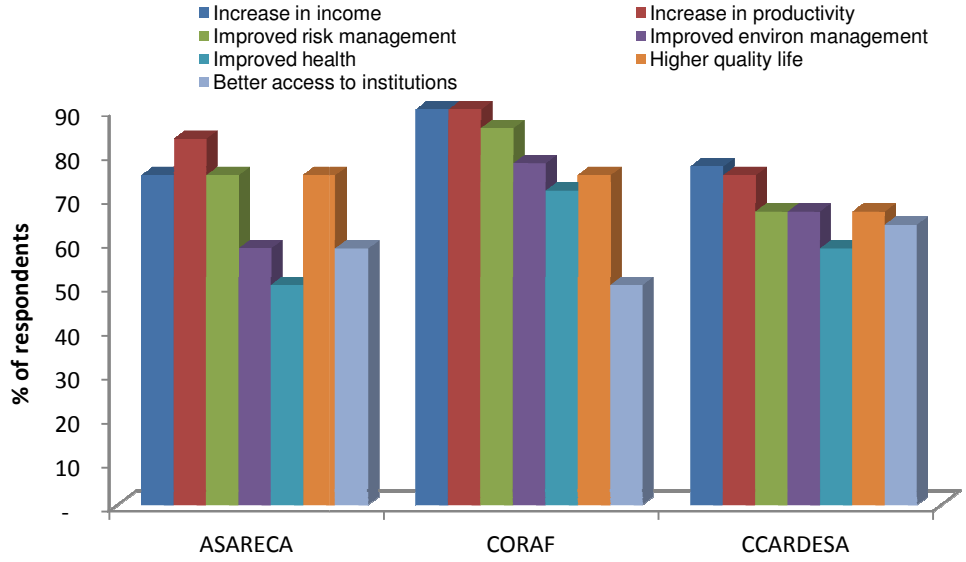

Figure 24: Stakeholders' perceptions on recent innovation benefits

10.4 Key Issues for Consideration

10.4.1 Issues from Literature Review and Survey Respondents

A number of issues for consideration emerge both from the review of existing literature information and results of the stakeholder survey as follows:

1) To a good degree, the linear mode of research-technology transfer-adoption persists in majority of the target countries. This is apparent in both the review as well as stakeholder responses. The AIS concept is still largely just a concept, with limited practical application in the national agricultural innovation strategies. Quite a few regional programs like FARA's SCARDA and SSA CP, DfID's RIU, and to an extent, the World Bank funded regional agricultural productivity programs (EAAPP and WAAPP) have tried to promote the concept in a number of countries. The FAAP also promotes inclusive engagement of stakeholders in the CAADP roundtable processes and well as implementation of the investment plans. Still, the AIS framework needs to be more clearly embedded in the national and regional agricultural strategies and programming. To do this, structures, systems and mechanisms - over and above the existing ones - would need to be formulated.
2) The public agricultural research institutes and universities are still the predominant contributors to innovations in terms of budget allocation, research output and sheer capacity. Non-state research contribution is only significant in sporadic cases like Zambia. Funding of research is mainly from government sources and, to some degree, international sources due to collaborative funding bids by university faculty. The review findings indicate that innovations could emanate from all types of actors, including smallholder farmers. However, farmer-led multi-stakeholder processes are rare. Moreover, the research agencies predominantly operate in 'silo' mode indicating the need for greater policy, research and end-user alignments. The disproportionate allocation of public resources to public research institutes is an area for policy innovation to incentivize other potential contributors to agricultural research and technical innovations.
3) All the reviewed countries had an impressive number of universities and other tertiary agricultural education institutes that can potentially contribute more significantly to agricultural innovations through research, involvement in policy dialogues and capacity development. To do this, governments would need to strengthen the enabling environment by facilitating favourable incentive schemes; development of national science, technology and innovation policies; and establishment of science, technology and innovation funds. Besides, there is need for policy reforms both at national and organizational level to re-position agricultural education institutes so that they can effectively play their roles of producing the required human capital to move Africa's agriculture, undertaking innovative research, and developing the capacity of other national agricultural innovation actors. The recent formation of TEAM-Africa and the NEPAD's ATVET initiative are direct responses to this concern. Better engagement of agricultural education institutes in national development issues e.g. the CAADP Country Roundtable process is also called for. Moreover, universities need to open up and engage end-users of their products (human capital and research findings) in their governance and innovation efforts.
4) Breakdown of government-led rural agricultural extension and advisory services (AEAS) in the last two decades due to financial austerity measures has necessitated the emergence of actors to fill the void. Currently, apart from residual services by government ministries and their departments, the main providers of extension services are NGOs, CSOs, farmer organizations, and universities. Various extension models have been applied with varying degrees of success in different settings across the continent and there are specific success stories that warrant out-scaling to other regions. These include demand-led models like 'fee-for-service' in eastern Africa or the MAFF in Francophone countries. A comprehensive assessment of extension models in the region is necessary to outline successful approaches for adoption elsewhere.
5) In many countries, AEAS policies are lacking and AEAS lack clear dissemination approaches that would effectively reach smallholders. The policy domain has also not sufficiently enabled the engagement space by non-state AEAS actors. Moreover, poor rural infrastructure in many countries

renders farmers inaccessible to advisory services. The use of ICT to improve access to extension services is an area for progressive innovation given the positive digital revolution in many African countries. However, none of the countries reviewed had exploited the enormous opportunities offered by ICT for extension. This is a clear case for convergence of agricultural, information and communication ministries to broker innovations in e-extension.

6) There is need for increased private sector participation in agricultural innovation processes – in research, extension, and funding. A number of issues affect private sector participation in innovations including distrust inherent in public-private-partnerships for R&D, difficulties to access technologies without IPRs, and lack of investment capital. Further, as the private sector is primarily motivated by profit, potential economic viability needs to be demonstrated a priori for them to engage in any of the innovation domains. Currently, this is not helped by the peasant nature of agricultural systems in many African countries. Repackaging smallholder agriculture as a business would unlock potential innovations by private sector players. This requires inclusive policy dialogues, changes in mindset and institutions, and an integrated approach to developing capacities at policy, institutional and individual levels for successful PPPs.
7) Policies on private sector engagement are misaligned with stakeholder expectations and there is lack of formal engagement protocols with the private sector. Especially, policy instruments to stimulate favourable business environment are called for. Further, the operational domain of private sector players currently seems to be limited to agribusiness. Yet, there is ample scope for increased involvement in research, provision of education services, extension and policy formulation. Development of a vibrant agribusiness in African countries depends on the success of locally owned SMEs. This necessitates appropriate legal and financial policies to encourage proliferation of SMEs (possibly under the TAP Policy Dialogue component) coupled with capacity development of SME investors to help them better manage their businesses.
8) Lack of finance or funding inevitably hampers innovations by all key actors. Key institutional developments are apparent in the region aimed at facilitating the provision of affordable agricultural finance. In addition, practical and successful models of agricultural financing exist in some countries orchestrated by continental platforms, NGOs, and donor agencies. The innovative gist in many of the models is risk reduction using various instruments like credit guarantee schemes and index insurance. Such models need to be evaluated and, if appropriate, adopted elsewhere. In the end, these financing innovations can only thrive with supportive policy instruments and adequate actor capacity; hence, the role of TAP's Policy Dialogue and the Marketplace.
9) A number of factors influence the level of participation of actors in the innovation processes. For smallholder farmers, the nature of their representation is important. The formation and leadership of farmer-based groups (FBOs) at national and sub-national levels is often spurious and unrepresentative. Ineffective FBOs, low capacity of FBO leaders, and non-representation of farmers in boards of regulatory agencies are other challenges. Furthermore, the regional FBOs are predominantly foreign funded, their accounts rarely audited, and the constituencies that they purportedly represent do not necessarily sanction their activities. This lack of financial and operational accountability leaves room for institutionalized malfeasance. In addition, there is apparent activity by FBOs at regional level with little cascading of actions to the grassroots. Effective end-user participation in agricultural innovation processes will only be possible if there are clear guidelines for representative self-organization (the enabling environment) and adequate individual and organizational capacities and channels for better demand articulation with the various innovation actors e.g. policy makers, researchers, education institutes, and extension workers.
10) Currently, no clear guidelines exist at the policy level on formation of farmer groups and this will be a good entry point under the TAP Policy Dialogue thrust. Knowledge co-creation with farmers and targeted capacity development for imparting negotiation skills are other means for empowering farmers to have their rightful niche in the value chains. Mechanisms to ensure representative and demand-driven evolution of farmer organizations are also needed. Low absorptive capacity, lack of financial services, technology and market access all adversely affect participation by farmers in innovations. Another factor is responsiveness of the other stakeholders to farmers' needs. Although important as innovators, universities were deemed the least responsive to farmers'

needs, while civil society organizations were the most effective in engaging farmers. This is an apparent corroboration of the 'ivory tower' epithet and an area for policy action by governments and university administrators. In a situation where governments are not effective brokers, CSOs (being most responsive to farmers' needs) can intermediate between universities/researchers and farmers to ensure demand-led innovations. The role of TAP may be to strengthen CSOs and NGOs actions in this regard.

11) The success of agricultural innovation systems depends on the power dynamics amongst actors. As alluded to above, public research agencies in majority of the TAP target countries apparently have more power based on the amount of budgetary allocation, research output, and role in setting research priorities. On the other hand, producer organizations also wield some forms of power as they are more connected with the grassroots. Along value chains, power disparities amongst actors are often evident, influencing prices and profits. Mechanisms to even out power disparities at various scales would be needed. An area where TAP could engage is conducting a comprehensive analysis of power dynamics in innovation systems among the key innovation actors at macro-level (i.e. government ministries, research institutes, education institutes, funding agencies, and extension workers) and within specific commodity value chains that are key to food security in the TAP countries. This will help identify strategies for power redistribution and cultivation of ambidextrous capacity in innovation networks.
12) Several innovative partnerships and platforms exist across Africa to address various issues ranging from research collaboration (e.g. PAEPARD), mobilizing investments in agriculture by engaging the private sector (e.g. Grow Africa), provision of inputs (e.g. Africa Fertilizer Agribusiness Partnership), technology development and adoption (e.g. AGORA, DONATA), research coordination (Africa Science Agenda), developing common standards and codes of practice (e.g. CIARD), transforming tertiary agricultural education (e.g. TEAM-Africa Partnership), and developing agribusinesses and agribusiness capacity (e.g. UniBRAIN). Indeed, FARA has recently initiated the e-Capacities platform, an online marketplace for matching the supply and demand in capacities for agricultural innovation. Triangular cooperation involving South-South-South, North-South-South, or other such combinations hold promise for agricultural success, having been proven elsewhere e.g. in Brazil. In Africa, this is typified by the ProSAVANA program to be launched in the Nacala Corridor of Mozambique and the Agricultural Innovation MKTPlace. Since TAP focuses on smallholder agriculture, the specific case of ProSAVANA partnership would appear to be a counter innovation in so far as it marginalizes rural peasants, while the Agricultural Innovation MKTPlace would serve as a good template for the TAP agenda.
13) As a framework, CAADP seeks to inspire institutional and policy transformation in order to meet the twin goals of securing investments and growth in the agricultural sector. Unfortunately, elaboration of pro-innovation policies has lagged even in countries well advanced in the CAADP process. Majority of the countries are still in the process of developing policies on key issues such as ICT, seed, science, technology and innovation, biotechnology and biosafety, climate change, and IPR. In the case of biotechnology and biosafety and climate change, regional policies are existent and the challenge is to cascade these to national levels. Obviously, innovations would be greatly facilitated if these policies were fully elaborated. At the national level, policy frameworks are demanded to address a number of issues – exclusion of stakeholders, incentives to innovate, innovation strategies, and legal frameworks to support innovations. Moreover, as indicated in the survey findings, policy-making processes tend to be exclusive and subsequent implementation is often top-down. This is inimical to the proliferation of innovation networks and requires capacity development in policy analysis, formulation and implementation.
14) In addition to the issues adduced from the review of available literature information on the target countries above, stakeholders in the three sub-regions provided their views on priorities for innovations based on a structured questionnaire. To address environmental challenges, the respondents prioritized innovations in soil and water management and climate change adaptation. The specific types of innovations to best address these challenges were further specified as agro-ecological techniques and practices and grassroots innovations at farmers level (e.g. rain harvesting). In terms of challenges to production systems, innovations in the areas of value-added processing, crop production, livestock production and crop-livestock systems were prioritized. On

economic and social challenges, the specified areas for innovation were varied across the three sub-regions. However, improving smallholder livelihoods, poverty reduction through entrepreneurship and women's participation were given top priority. The specific innovations in these areas were further identified as platform technologies with low-cost, user-friendly products and grassroots innovations.

15) All the three regions indicated that reform of public extension system would also address, albeit to a lesser degree, economic problems. Unlike ASARECA and CCARDESA, respondents from the CORAF/WECARD sub-region were more positive on the utility of market and public extension reforms in addressing environmental issues. On innovations in government policy instruments, business mentoring and microfinance were regarded as best bet innovation areas to address economic challenges in ASARECA and CCARDESA, and to a lesser degree in CORAF/WECARD
16) Respondents in all regions preferred provision of government incentives such as tax credits, matching grants, and joint-cooperation platforms to foster PPPs in innovations. The need for patent pooling and e-licensing platforms were more popular in CCARDESA, while national marketing boards were favourably considered in CORAF/WECARD. Apart from the options specified in the questionnaire, the survey respondents also specified business mentoring and microfinance as one area that could be considered on the policy front. Women's participation in innovation activities could be improved by enacting laws to mainstream gender issues in agricultural actions, revision of land tenure systems, and attendance of innovation exhibitions.
17) The major innovations in the last five years specified by respondents across the three sub-regions were in the areas of value added commodity products, market access, water and natural resources management, new crop technologies, inclusive financial models and climate-smart technologies. The main innovation challenges were identified as lack of resource endowments, negative attitudes and practices, climate change-related aspects, and lack of access to markets. The opportunities that motivated the innovations include abundant natural resources, collaborative linkages, conducive investment policies, new markets, capacity for innovation, and positive attitudes towards new technologies. In addition, the respondents indicated that the innovations benefitted from a coherent NAIS to varying degrees in the sub-regions. The main benefits of the innovations were identified as increased productivity, increased incomes and higher quality of life.

10.4.2 Issues from Stocktaking of Capacity Development Initiatives

10.4.2.1 Enabling Environment Issues

As shown in Table 5 – 7, the major issues on enabling environment were mainly two-fold: institutional and policy impediments. The identified institutional issues include:

1) lack of institutional capacity for national data acquisition, sustainable development, ministry environmental units, and information access;
2) financial constraints - lack of funding, limited access to credits, lack of financial services in rural areas, lack of access to extension services, and the need to engage the informal sector in funding;
3) market constraints - government interference in markets, weak marketing institutions and poor infrastructure, and distorted agricultural market environments due to stakeholder power imbalances;
4) governance – lack of political stability especially in post-conflict situations, weak public service, poor logistical support, poor bureaucratic procedures and governance; and
5) other technical constraints like high input/production costs.

Regarding policy, the following issues were identified:

1) burdensome regulations;
2) lack of institutional framework and legislation for engaging the CSOs;
3) insecure and unsustainable land tenure systems;
4) insufficient consideration of environmental issues in government plans;
5) lack of ICT policies;

6) incoherence of policies and misalignment of institutional mandates; and
7) lack of legal and regulatory framework for agricultural finance.

Table 5: Enabling Environment Issues Identified in ASARECA

Country	Issue 1	Issue 2	Issue 3	Issue 4
Comoros	Statistics are of poor quality and collected at irregular intervals; and different sources give varied figures for development issues	Absence of long-term strategic vision on sustainable development and management of natural resources; the natural resources drive the Comoros' economy	Insufficient budgetary resources	Political arena is still fragile, after many years of civil strife
Ethiopia	High transaction costs due to weak marketing institutions and infrastructure	Security of land tenure, hence property rights not conducive to commercialization of agriculture	Limited use of improved production practices, linked to low literacy levels	Inadequate access to services like extension and credit
Mozambique	Large investors and donor priorities have been reigning	Deficient infrastructure and burdensome regulations	Weak human capital	High cost of credit
Rwanda	Youth unemployment and underemployment	Mismatch of skills in production areas		
South Sudan	Fragile economy, coming up from political challenges	Limited domestic production and high reliance on imports	Shortage of skilled human resources	Weak public service delivery systems
Tanzania	Underperforming agriculture	Infrastructure bottlenecks		
Uganda	Poor bureaucratic procedures and governance			

Table 6: Enabling Environment Issues Identified in CORAF/WECARD

Country	Issue 1	Issue 2	Issue 3	Issue 4
Burkina Faso	Absence of an institutionalized framework of engagement of CSOs	Lack of harmonized legislations governing Various CSOs	CSOs do not receive funds for implementation of national actions plans, and are not involved in the monitoring of these actions plans	The political and policy space provided for CSOs in development planning and monitoring is not commensurate with the legal environment for CSOs operations
Benin	Insufficient integration of environmental considerations into ministries plans, projects and programmes	Low capacity of the Environmental Units within key ministries	Weak Monitoring/Evaluation system put in place	Weak developing capacity of sectors to deliver often requires coordination, collaboration and communication across multiple sector and organizational boundaries.
Gambia	Poor integration and coordination	Lack of funding	Poor logistics support	Inadequately trained personnel
Liberia	No national policy specific to ICT or even one for ICT for health information	Inadequate fund	Poor Understanding of the relevance of informal institutions of donors	Insufficient Incentives to individual performance in the public sector
Niger	Inadequate funding for projects to promote access to electronic health	Limited access to information (access to international journals)	Weak policy coherence and alignment of institutional mandates	Open the dialogue and learning between country and development partners

Table 7: Enabling Environment Issues Identified in CCARDESA

Country	Issue 1	Issue 2	Issue 3	Issue 4
Angola	The cost of conducting agricultural business high.	Poor transport infrastructure.	Lack of a credit market	Lack of developed human resource
Lesotho	Lack of a good land tenure system and trade regime	Lack of skills	Lack of suitable financial and insurance packages specifically designed for farmers	
Malawi	High cost of inputs e.g. price of fertilizer is 20-50% higher than countries in the region	Limited human resource e.g. weak livestock unit	Inadequate availability of credit for farmers	Fragmented land holding (Not equitable)
Mozambique	Absence of formal financial services in rural areas	Poor roads, energy in urban areas and almost non-existence in rural area	Lack of rural infrastructure	High agricultural transaction costs
Zambia	Too much Government intervention in agricultural markets	High costs of agricultural production	Lack legal and regulatory framework for agricultural finance.	Lack of transparent and secure agricultural marketing environment

Sources: (***FANRPAN, 2009; Chirwa, 2006; CTA, 2000; Mokom, 2010; wwwfarmersweekly.co.za)***

10.4.2.2 Private Sector Mobilization

As shown in Table 8 – 10, private sector mobilization issues that need attention were categorized threefold: *institutional, policy*, and *human* factors.

1) Under institutional factors, the main issues were to do with governance, investment climate, coordination, knowledge flows, and private sector size. On governance, weakened checks and balances and political interference were identified in some countries. Issues on investment climate were poor rank on ease of doing business, monopolistic tendencies in private sector, business climate not conducive, high cost of capital, and poor R&D infrastructure to enable private sector participation in innovations. Deficiencies in coordination included lack of inter-sectoral linkages; lack of collaboration between public and private extension providers; little or no coordination of international NGOs engaged in agriculture; poor coordination of agricultural and food security programmes (i.e. poor coordination of various interventions being implemented by government, NGOs and cooperating partners); lack of synergies in public-private investments; and lack of commodity-focused joint venture companies. Issues on knowledge flows included lack of data on private sector R&D and lack of information access especially from private sector. These would be remedied by capacity development interventions on the identified areas.
2) Policy issues were identified as lack of policy dialogues between government and private stakeholders, lack of PPPs, lack of private sector incentives, rigid or high interest rates constraining access to business finance, property or land rights not conducive to commercialization of agriculture, lack of institutional and regulatory frameworks (especially under fragile political situations), import-based economies to the detriment of local products, and other policy and institutional issues constraining private sector investment. The concerns here can be addressed by policy innovations and dialogue.
3) Human factors included poor mindset of private sector actor to participate in agricultural R&D and lack of long-term vision when it comes to the benefits of research. Capacity development, including mentorship would address this constraint.

Table 8: Private Sector Issues in ASARECA

Country	Issue 1	Issue 2	Issue 3
Comoros	Absence of strategic dialogue between government and private stakeholders	Lack of institutional and regulatory frameworks, in a still fragile political arena	The economy favours imports over local goods
Ethiopia	Property rights not conducive to commercialization of agriculture	Rigid interest rates determination (in practice)	limited opportunities for the private sector to leverage large public investment, facilitated partly by low nominal interest rates
Mozambique	Weakened checks and balances in controlling state apparatus; politics interfering	High cost of capital	Projects financed by foreign capital dominate the economy
Rwanda			
South Sudan	Poor rank on ease of doing business		
Tanzania	Poor rank on ease of doing business		
Uganda	Poor rank on ease of doing business		

Table 9: Private Sector Mobilization Issues in CORAF/WECARD

Country	Issue 1	Issue 2	Issue 3
Burkina Faso	Comprehensive information on R&D conducted by the private sector is not regularly documented.	Dominance of Small private sector in size	The private share of both consumption and investment was below the continental median
Liberia	Poor mindset of private sector actor to participate in agricultural R&D	Private sector operating with limited competition, a factor that discourages major R&D investment.	lack of long-term vision when it comes to the benefits of research
Gambia	Limited extensive R&D infrastructure	Collaboration boundaries between public and private R&D investments	Little reliable data currently exists on how much agricultural R&D and innovation from the private
Liberia	Poor infrastructure enabling private sector to be involved in agriculture R&D	The private sector relatively underrepresented in the conduct of agriculture R&D	Private sector companies operating with limited competition, discouraging Agriculture R&D investment.

Niger	Poor Public and Private Partnerships	Insufficient business climate, for both the indigenous private sector and foreign investors	Policy and institutional issues constraining private sector investment

Table 10: Private Sector Mobilization Issues in CCARDESA

Country	Issue 1	Issue 2	Issue 3	Issue 4
Angola				
Lesotho	Poor private sector investment			
Malawi				
Mozambique	Weak progress on establishing and promoting their inter-sectoral linkages	Limited collaboration between public-private extension providers	Little or no coordination of international NGOs engaged in agriculture	Lack of commodity-focused joint venture companies into a national scheme
Zambia	Poor coordination of agricultural and food security programmes, i.e. poor coordination of various interventions being implemented by government, NGOs and cooperating partners	Lack of private sector incentives		

Source: ***(www.lesothoreview.com/introduction , MACO, 2004; FANRPAN, 2009; Mulemba, 2009; www.eldis.org)***

10.4.2.3 Empowering Rural Men and Women

The following factors were identified as constraints to women participation in agricultural innovations (Table 11 – 13):

1. *Institutional* (inadequate financial resources, insufficient information resources, gender inequalities, resulting to inequalities in access to financial resources, inadequate capacity and access to factors of production by women, lack of small scale inclusion, and inadequate extension services);
2. *Cultural factors* (the matrilineal nature of inheritance in the society places women at a better position than men, lingering gender disparities despite being signatory to several protocols against all forms of gender discrimination, inequality in resource ownership and use, wrong perception on women capabilities, skills and potential, limited participation in decision making characterized by men's domination on women); and
3. *Human factors* (low literacy levels, participation rate of women in business and decision making is low, literacy levels of women relatively lower than for men (63% against 47% in some countries), limited human resource, and HIV/AIDS prevalence.

Table 11: Factors Affecting Women Participation in Innovations in ASARECA

Country	Issue 1	Issue 2	Issue 3
Comoros	The matrineal nature of inheritance in the society places women at a better position than men; a balance may be necessary	Low literacy levels	Inadequate financial resources
Ethiopia	Insufficient resources	Participation rate of women in business and decision making is low	Literacy levels of women relatively lower than for men (63% against 47%)
Mozambique	Literacy levels for both men and women still relatively low		
Rwanda	Low literacy levels although coming up steadily		
South Sudan	Low literacy levels across the board	Inequality in resource ownership and use	
Tanzania	Low literacy and skills		
Uganda	Lingering gender disparities, despite being signatory to several protocols against all forms of gender discrimination		

Table 12: Factors Affecting Women Participation in Innovations in CORAF/WECARD

Country	Issue 1	Issue 2	Issue 3
Burkina Faso	Wrong perception on women capabilities, skills and potential	Gender inequalities, resulting to inequalities in access to financial resources	Limited participation in decision making characterized by men's domination on women
Liberia	Gender inequalities, resulting to inequalities in access to financial resources	Women low self-esteem resulting to failure in use of loans and credits	Limited participation in decision making characterized by men's domination on women
Gambia	women have a higher incidence, vulnerable and severity of poverty compared to men	Inadequate capacity and access to factors of production by women	Limited participation in decision making characterized by men's domination on women

Liberia	Limited micro finance oriented to rural women and men empowerment	Gender inequalities, resulting to inequalities in access to financial resources	Limited participation in decision making characterized by men's domination on women
Niger	women have a higher incidence, vulnerable and severity of poverty compared to men	Women are more vulnerable to preventable illnesses and violence, and they have far fewer opportunities to become educated or to earn a living	Limited participation in decision making characterized by men's domination on women

Table 13: Factors Affecting Women Participation in Innovations in CCARDESA

Country	Issue 1	Issue 2	Issue 3	Issue 4
Angola				
Lesotho	Lack of small scale inclusion	HIV/AIDS reducing labor capacity		
Malawi	Limited human resource			
Mozambique	Inadequate extension services			
Zambia	Inability to bear risks by farmers			

Source: ***(farmersweekly.co.za; World Bank Report, 2008; FANRPAN, 2009; Phiri et al. 2012; Kruchem, 2011)***

10.4.2.4 Demand-led Extension Capacity

The much-hyped concept of agricultural commercialization that seeks to promote market-led service provision has failed to reach sustainable levels in Africa because some of the requisite conditions and operations are inadequately provided. These include (Tables 14 - 16):

1) Difficulty in changing farmers' attitude to embrace farmer-led extension approach
2) Inadequate consultation of farmers in extension design process
3) Weak collective action due to farmer group challenges
4) Inadequate extension content and limited access to modern technologies
5) Poor absorptive capacity and mindset challenges of farmers in relation to new technologies
6) Poor extension infrastructure and logistics
7) HIV/AIDS epidemic affecting agricultural extension organizations and clientele

Table 14: Demand-led Extension Challenges in ASARECA

Country	Issue 1	Issue 2	Issue 3
Comoros	There is no motivation to seek for improved practices	Inadequate extension and access to modern technology	Land management is dictated by individuals rather than collective responsibility
Ethiopia	Limited use of improved farming practices	Only about 15% of the arable land is in use, and there is domestic demand for production	
Mozambique	Agriculture is still largely subsistence		

Table 15: Demand-led Extension Challenges in CORAF/WECARD

Country	Issue 1	Issue 2	Issue 3
Burkina Faso	Change of attitude issue, it is difficult for farmer to adopt farmer-led extension approach	Inadequate extension and access to modern technology	Problem related to Financial commitment entailed in the continued operation related to innovation through farmer-led extension approach
Liberia	Low farmers responses to extensions services/low technology adoption	Poor farmer's basic knowledge and ability to make their own choices and decision on particular technologies	Difficult for farmer to adopt farmer-led extension approach
Gambia	Little direct consultation with the farmers to whom the extension technologies, information and associated services are intended	Lack collective voice due to insufficient farmer cooperative and other Farmer organization	Poor identification and promotion of authentic farmer of organization that empower small household
Liberia	Difficult for farmer to adopt farmer-led extension approach	Leader issue, farmer–led extension participatory planning is still dominated by village leaders or a number of wealthier farmers, the voice of the poor farmers is neglected	Logistics issue for extension officers
Niger	Difficult for farmer to adopt farmer-led extension approach	Farmers conflict a barrier for extension	Lack collective voice due to insufficient farmer cooperative and other Farmer organization

Table 16: Demand-led Extension Challenges in CCARDESA

Country	Issue 1	Issue 2	Issue 3	Issue 4

Angola				
Lesotho				
Malawi	Weak extension delivery services	Lack of research to recoup the benefits of genetic improvement research		
Mozambique				
Zambia	Lack of technical logistics	HIV/AIDS epidemic affecting agricultural extension organizations and clientele	Limited access to extension	

Sources: ***(Phiri et al. 2012;*** *www.fao.org* ; ***www.zamace.com ; www.worldbank.org ;*** *http://www.ifpri.org/divs/tmd/dp/papers/tmdp47.pdf www.fao.org/sd/CDdirect/Cdre0017.htm*.

10.4.2.5 Demand-led Research Capacity

Research and technology generation are critical in the innovation process. Moreover, research products and inventions must be adapted to fit the agro-ecological environment and socio-economic contexts in which they are to be applied. Thus, the research must be in response to agricultural market demand. However, as shown in Tables 17 and 18, effective generation of demand-led research in SSA is constrained by the following issues:

1) poor funding and low public investment in research;
2) weak linkages and partnerships between research and other stakeholders;
3) slow adoption of AIS practices;
4) under-developed value chains;
5) shortage of skilled human resources;
6) over-reliance on donor funding leads to unsustainable R&D;
7) limited policy impact of research;
8) weak partnerships between researchers and other local level stakeholders hinder adoption of technologies;
9) failure to incorporate all stakeholders in research agenda-setting; and
10) inadequate technical skills and competencies on key research issues, particularly on emerging critical issues such as climate change management and alternative energy generation.

Table 17: Demand-led Research Capacity Challenges in ASARECA

Country	Issue 1	Issue 2	Issue 3
Comoros	Efforts have not been adequate since the civil strife	Lack of funding to support and strengthen Agriculture research	No known formal linkages between research extension and farmers
Ethiopia	Many research initiatives centered in Ethiopia, including CGIAR centres, which need more balanced coordination	Low productivity, poor management systems	
Mozambique	Agriculture is still largely subsistence, characterised with low productivity		
Rwanda	The innovation platform approach is taking root, but relatively slowly	Success stories like the bean research network are promising for other enterprises	
South Sudan	Over-reliance on food imports	Low production and productivity	Shortage of skilled human resource
Tanzania	Many of the most experienced researchers have retired and are continuing to work on short term contract	Lack of coordination between researchers	Lack of linkage of research with other stakeholders
Uganda	Low productivity	Underdeveloped value chains	Low public investment

Table 18: Demand-led Research Capacity in CORAF/WECARD

Country	Issue 1	Issue 2	Issue 3
Burkina Faso	Efforts inadequate policies to promote Agriculture research	Lack of fund support, and the strengthening Agriculture research	Poor Linkages between public research agencies and private research agencies
Liberia	Public agricultural R&D rely heavily on donor funding	Reduced support by the donors led to gradual drop in the country 's overall agricultural R&D spending	Inadequate and sustainability of funding for research capacity building
Gambia	Policies promoting participation	Poorly adapted organizational and Institutional structures	Weak networks in which the producers of knowledge work together and closely

			interact with the potential end users
Liberia	Limited integration of knowledge and skills from different disciplines	Agenda setting and prioritization of stakeholder participation not reflecting the societal need	Limited impact of research generated on policy
Niger	Weaknesses in existing research actors partnerships	Researchers who don't interact closely in local life	Lack of quality assurance for research supported by capacity strengthening programmes

10.4.2.6 Marketing Issues

As shown in Table 19, the identified marketing issues (especially in the CCARDESA sub-region) include high farm-gate prices due to high input costs, lack of market information and market access, and price instabilities and distortions.

Table 19: Identified Constraints to Marketing

Country	Issue 1	Issue 2	Issue 3	Issue 4
Angola				
Lesotho	High food and input prices	Lack of developed input market	Lack of output markets that links the supply chain retailers	
Malawi	Lack of information is characteristic of remote areas	Unreliable or non-working markets	Inability of government and donors to reach sustainable solution to failure of agriculture credit markets	Low and volatile output prices
Mozambique	Little is being done to assist the development of input and output markets			
Zambia	Lack of information hinders small-scale farmer participation	Price instability for both consumers and producers	Limited of domestic market	Poor functioning agricultural grain markets, which limit small scale farmers to access markets

Source: (www.lesothoreview.com/introduction MACO, 2004; Jayne et al.; FANRPAN, 2009; Chirwa, et al., 2006; Phiri et al. 2012; Mokom, 2010)

10.4.2.7 Human Capacity, Agricultural Education and Training Issues

The human capacity issues listed here (Table 20) also pertain to the various AIS aspects already discussed above. They are as follows:

1) Mismatch of skills in production areas
2) Shortage of skilled human resources and inadequately trained personnel
3) Low coordination capacity for program implementers
4) Lack of incentives to individuals leading to low morale and underperformance
5) Lack of M&E capacity

The AET issues identified are as shown in Table 19 and include:

1) Lack of physical and other pedagogic infrastructure
2) Low staff remuneration
3) Lack of clear policies on AET
4) Low funding
5) Coordination difficulties and policy conflicts as AET institutions belong to different line ministries
6) AET training is not market responsive

Table 20: Issues Concerning Agricultural Education and Training in CCARDESA

Country	Issue 1	Issue 2	Issue 3	Issue 4
Angola	The predominance of traditional agriculture	Lack of quality agricultural education system	a lack of school buildings and teachers	Teachers still tend to be underpaid, inadequately trained, and overworked
Lesotho	Lack of value training approach			
Malawi	Limited Budgetary allocation	Poor infrastructure to support initiatives for improved productivity through training		
Mozambique	Incentives for investment are slow and highly			

	bureaucratic			
Zambia	Previous agricultural policies have lacked clear education and training objectives to meet the needs of changing agricultural landscape.	Declining national budgetary allocations to educational institutions have seriously undermined infrastructural development and flexibility in education service delivery	Different agricultural institutions administratively belong to different sectors/sub-sectors and thus management of education and delivery of agricultural training programmes has been problematic	There has been a disconnection between educational institutions and other sub-sectors of the agricultural industry, resulting in training curricula which are insensitive to the changing overall national agricultural agenda

Source: ***(World Bank: Angola- Agric Sector 2011; Chikoye et al 2007; FANRPAN, 2009; Phiri et al. 2012; Mokom, 2010;*** Kaarhus et al. 2006)

10.4.2.8 Input Subsidy Issues

The identified input subsidy issues are low repayment rates, depressed repayment incentives, low level of input use, insufficient time for input supply, lack of input sustainability, financial sustainability, corruption, delay in distribution, and lack of inputs.

10.4.2.9 Agricultural Technology Development Issues

As given in Table 21, issues hampering agricultural technology development include lack of investment in research and research infrastructure, poor adoption rates due to a number of factors such as access to and affordability of technologies, and lack of technologies to address compelling challenges i.e. effects of climate change on crop and livestock systems.

Table 21: Agricultural Technology Development Issues

Country	Issue 1	Issue 2	Issue 3	Issue 4
Angola				
Lesotho	Low adoption of more efficient and sustainable production methods and adaptation to climate change	Lack of technology for early warning against climate-induced disasters and hazards	Lack of technology for resilience livestock and crop production systems	
Malawi	Low investment in Agricultural technology	Limited collaboration amongst Researchers and also with extension workers	Limited infrastructure and general equipment for research	Skewedness of technology towards some specific areas
Mozambique	Limited to access to technology			
Zambia	Lack of appropriate technology to tackle post-harvest losses	Low purchasing power of the majority of the population to afford the technology	Limited diversification of agricultural production	Lack of research leads to environmental degradation due to unsustainable agricultural practices

Source: ***(Mokom, 2010; MACO, 2004; Rajalahti et al. 2009; FANRPAN, 2009; Phiri et al. 2012)***

11. CONCLUSIONS AND RECOMMENDATIONS

11.1 Generic recommendations

The TAP will work through a multi-pronged approach involving:

- "Policy Dialogue Space": convening multi-stakeholder interactions which enhance clarity and coherence of national policies for capacity development in tropical agricultural innovation systems;
- "Marketplace": brokering effective capacity development approaches and partnerships in tropical agriculture which aggregate and promote existing demands and offers, and facilitate up-scaling;
- "TAPipedia": creating an information system that enhances knowledge flows in support of capacity development of tropical innovation systems, capturing success stories, socioeconomic impacts, lessons learned, and innovation outputs.

A. The following recommendations would be for the "Policy Dialogue Space":

- Policy innovation to incentivize other potential contributors to agricultural innovations apart from public research and universities
- Formulation of systems, structures, and mechanisms to embed NAIS concepts in national and regional agricultural strategies and programming
- Policy reforms both at national and organizational level to re-position agricultural education institutes so that they can effectively play their roles of producing the required human capital to move Africa's agriculture, undertake innovative research, and develop the capacity of other national agricultural innovation actors
- Facilitating convergence of agricultural, information and communication ministries to broker innovations in e-extension by policy alignments
- Inclusive policy dialogues to repackage smallholder agriculture as a business and thereby unlock potential innovations by private sector players
- Appropriate legal and financial policies to encourage business mentoring, proliferation of SMEs and financing innovations
- Guidelines for representative self-organization by smallholders (formation of farmer groups) to strengthen their participation in agricultural innovation systems
- Changes in university and research organizational operational and governance policies to shed off the 'ivory tower' label and be more open to farmer needs
- Policy dialogues - to address market constraints, input access, extension provision, governance issues, ICT, regulatory framework for micro-finance and IPR issues, incoherence of policy frameworks addressing similar issues, coordination problems due to public actors with same functions being controlled by different line ministries, knowledge flows, inclusive stakeholder engagements in policy formulation and programs, property and land regulations, gender, inheritance laws, innovation agenda setting and prioritization

B. The following recommendations would apply to the "Marketplace":

3. Individual/human capacity development (at country and regional level; this would be capacity offers on the demand side)
    a. Partnership building and collaborations for enhance capacity to facilitate multi-stakeholder processes – farmers, researchers, extensionists, university staff
    b. Group dynamical skills to help in engaging other stakeholders and value chain actors - farmers, researchers, extensionists, university staff
    c. Coordination skills – programme coordination staff in government ministries; FBO leaders; researchers and university staff
    d. M&E skills – programme coordination staff, researchers and university staff
    e. Strategic thinking – FBO leaders, public policy makers, university staff, researchers
    f. Policy development skills – policy making staff in government ministries, universities, and research institutes, FBOs, extensionists
    g. Business and financial management skills – farmers, FBO leaders, SME investors
    h. Corporate governance skills – FBO leaders, policy makers and agribusiness executives

i. Mentoring and mindset changes – to transform peasants into commercial farmers and wary private sectors into active innovators
j. Retooling of university staff to be able to produce innovative graduates
k. Social inclusion training to eliminate institutional, cultural and human factors hindering integration of women and other under-represented groups in agricultural innovations

4. Organizational capacity development (these would be offers on the demand side)
    a. Infrastructural endowment of innovation actors – research institutes, universities (this could be at national or supra-national scales)
    b. Rural access infrastructure – roads, ICT and mobile access
    c. Business incubation facilities – to stimulate agribusiness ventures by young people
    d. Curricula and pedagogic reforms at universities in TAP countries
    e. Customizing strategies of actor organizations to respond to national development needs
    f. Regional technology hubs or centers of excellence on crossborder issues of contemporary significance e.g. climate observatory centers, technology intelligence centers, or IPR agencies
    g. Incentive structures – for researchers, university staff and private sector/agribusiness

C. The following would be for the "TAPipedia":

f. Comprehensive assessment of extension and agricultural finance models in the region to outline successful approaches for adoption elsewhere
g. Exhaustive inventory of capacity offers or demands currently active in the African countries
h. Exhaustive inventory of agencies providing capacity development funding or technical assistance
i. Inventory of success stories on innovation in Africa and beyond to positive contagion elsewhere (this would need to be done and submitted to the TAPipedia repository)
j. Inventory of all key organizational actors in each of the TAP countries and the major areas of their innovation activities (this would need to be done further and the submitted to the TAPipedia repository)

11.2 Specific recommendations

Some more specific actions points may be as follows:

11.2.1 Integration of smallholders and other value chain actors in the innovation process (for the TAP Policy Dialogue Space)

- Involve farmer groups and agro-based micro-enterprises in the design of technologies, for example through establishment of rural agri-technology hubs and agribusiness incubators
- Transfer development of foundation technologies (e.g., foundation seeds) from public agencies to private sector to encourage widespread entrepreneurial culture/up-scaling of agricultural innovations
- Intensify policy monitoring and budget management for agricultural innovations
- Create appropriate legislations to incorporate community-based extension workers in national extension systems, for example facilitate their registration/licensing to provide services

11.2.2 Capacity development (for the TAP Marketplace)

- Revise the content of agricultural courses in local institutions to offer more technical skills that can readily address emerging challenges such as climate change
- Provide continuous hands-on training to officials of regulatory authorities to improve their oversight role in the design and application of innovations
- Package information on innovations and value addition in languages and formats that can be easily understood and applied by the smallholder farmers, especially those without formal education

- Strengthen local agricultural education institutions' capacities to offer relevant and high quality advanced training (possibly at PhD and postdoctoral levels) in critical areas of agricultural innovations where such capacity is still lacking, for instance climate change science, natural resource engineering and value chain modifications

11.2.3 **Private sector investments** (for the TAP Policy Dialogue Space)

Promote private sector investments for agricultural innovations through:

- Collaborative planning and implementation of research activities
- Development and enforcement of Memorandum of Understanding
- Provision of tax incentives (e.g., zero tax on inputs used by private firms that invest in technology development)
- Transparency and consistency in policies that affect private investments
- Establish a recognition system for private entrepreneurs to invest in innovations as a core corporate social responsibility activity
- Develop an intellectual property rights (IPR) system that safeguards innovations.

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13. APPENDICES

Appendix 1: Summary of survey responses

Region	Country	Institution	Respondent	Respondent's contacts	Responses		
					Expected	Received	%
ASARECA	Rwanda	Rwanda Agriculture Board	Vicky Ruganzu	B.P 5016 Kigali, Tel: Fax: +250 788562938 rugavicky@yahoo.fr, Vicky.ruganzu@rab.gov.rw	7	5	71.43
			Leonidas Desengemungu	P.O. Box 5016 Kigali- Rwanda Tel: +250 788617194 leonidasdusenge@yahoo.com			
		National Agricultural Export Board	Celestin Gatarahiya	+250 788267481			
		Agribusiness Focused Partnership Organization	Jean Bosco Safari	Tel: Fax: +250788520914 agrifop.org@gmail.com; sjboscofr@gmail.com			
		Ministry of Agriculture and Animal Resources	Beatrice Uwumukiza	+250788848410			
	Tanzania	Agricultural Non-State Actors Forum	Alawiya Mohamed	+255 22 2771566 / 2775970	7	2	28.57
		Agricultural Council of Tanzania	Janet Bitegeko	P.O. Box 14130 Dar es Salaam Tel: Fax: +255 22 2128032 jbitegeko@actanzania.or.tz jbitegeko@hotmail.com			
	Ethiopia	Haramaya University	Samson Eshetu Lemma	eshetusamson@gmail.com Tel : 251 911084779/927818875	7	1	14.29
	Uganda	National Agricultural Research Organization	Stephen Ojangole	P.O. Box 295, Entebbe sojangole@gmail.com	7	4	57.14
		Excel Hort Consult Ltd.	Anke Weisheit	P.O. Box 664 Mbarara Tel: +256-772-888096 aweisheit@excelhort.com, ankeweisheit@web.de			
		Kyambogo University	Peter Milton Rukundo	+256782425076			
		Uganda National Farmers Federation	Augustine Mwendya	PO Box 6213, Kampala, Plot 27 Nakasero Road Tel: +256 414 230705/+256 772 616 926 Fax:+256 414 230748 unfa@starcom.co.ug; amwendya@yahoo.co.uk			
	Kenya	Access Agriculture	Bob Muchina	P.O. Box 666158 - 00800 Nairobi Tel: +254 20 210 8 3000 muchinabob@accessagriculture.org	7	1	14.29
CORAF/WECARD	Burkina Faso	University Polytechnic	Valerie Bougouma	01 BP 1091 Bobo-Dioulasso bouval2000@yahoo.fr	7	3	42.86
		INERA	Traore San				
		Women Environment Programme	Zenabou Segda	06 PB 10743 OUAGADOUGOU 06 Tél : Fax : +226 70234930 SEGDAORAMA@GMAIL.COM			
	Niger	NGO	Ali Ramathan Sekou Maina	BP. 185 Tél: 227 20 75 47 34	7	7	100
		Abdou Moumouni University	Idi Adamou	00 227 97 26 67 22			

				idigata_adam@yahoo.fr			
		EIP-Niger	Assane Salifou	BP 11 867 Tél : 00 227 96 97 74 19; 00 227 91 27 92 98 salif_eipniger@yahoo.fr			
		Centre Regional AGRHYMET	Djibo Hamidor	BP 11011 Tél : : 00 227 98 49 74 21 H.Djibo@agrhymet.ne			
		Ministry of Agriculture	Maiga Azouhour	Niamey BP 323 Tél : 00227 20 73 22 93 azouhour_maiga@yahoo.fr			
		Centre Regional de la Recherche Agronomique	Saidou Halima Elhadj Djibo	CERRA/INRAN BP : 429 Tél : 00 227 90 21 10 37 nourah36@ymail.com			
		Reseau National des Chambres d Agriculture du	Mohamed Elmoctar	Bp 686 Niamey Tél : 00227 96 26 02 62 Fax : recaniger@yahoo.fr, Mohamedelmoctar_y@yahoo.fr			
CCARDESA	Zambia	Mulungushi University	Olusegun Yerokun	+260 215 222141	7	5	71.43
		Indaba Agricultural Policy Research Institute	Munguzwe Hichaambwa	260 977 867 610			
		Zambia Agricultural Research Institute	Davy Simumba	Mount Makulu Research Station Private Bag 7 Chilanga, Zambia Tel: +260-1-278130 Fax: +260-1-278130 zaridirector@zari.gov.zm			
		Frontier Development Associates	Gulam Banda	P.O. Box 320249, Lusaka Tel: +260 211 267885 Fax: +260 211 267885 gulam@frontierda.com or innovation@frontierda.com			
		Ministry of Agriculture and Livestock	Christopher Mbewe	+260977784022			
	Angola	Ministry of Environment	Albertina Nzuzi	Tel:+244 924991915	7	1	14.29
	Lesotho	Department of Agricultural Research	Molapo Maletsie	Tel: +266 58929273, +266 22312395	7	7	100
			Simon Bereng	P O BOX 829 Maseru 100 Tel: +266 22 310 362 s_bereng@yahoo.com			
			Mpho	Tel:+266 58996746			
		National University of Lesotho	MV Marake	P.O. Roma 180 Tel: Fax: +26622340000 mv.marake@gmail.com; mv.marake@nul.ls			
		Lesotho National Farmers Union	Motsau Khuele	Tel: 22327009 / 58852475			
		Department of Agricultural Research	Molatela	+266 62965880/58765880, +266 22312395			
		Ministry of Agriculture and Food Security	Mookho Shea	Box 24, Maseru 100 Tel: 22326235 Fax: sheamookho@gmail.com			
Total					**105**	**33**	**31.43**

Appendix 2: Country Development Indicators

Country	Population (millions), 2009	Annual population growth rate (%) (SSA=2.5)	Land area ('000 km^2)	GDP per capita (USD$), 2009 (SSA=618)	Average annual GDP growth rate, 2000 - 2009 (%) (SSA=2.1)	Gini Index, 2000 - 2009	Human Development Index (HDI), 2012 (SSA=0.463)	Ease of Doing Business (Rank among 186 Countries), 2013	Agricultural value added (% share of GDP), 2009	Average Total Factor Productivity (TFP) in agriculture (1981 – 2001)	Average TFP growth, 1961 – 2008 (% per year)	Share of population below USD$2/day, 2009
ASARECA*	**34.3 (37.2)**	**2.68 (0.22)**	**478.25 (538.74)**	**332 (95.26)**	**3.38 (2.45)**	**46.20 (15.47)**	**0.43 (0.03)**	**117.75 (45.80)**	**41.93 (11.58)**	**-0.20 (0.80)**	**0.18 (0.61)**	**80.03 (11.33)**
Ethiopia	82.8	2.6	1,000	201	5.3	29.8	0.396	127	50.7	0.73	0.09	77.6
Rwanda	10	2.8	25	334	4.5	53.1	0.434	52	-	-0.71	-0.39	89.6
Tanzania	43.7	2.9	886	426	3.9	37.6	0.476	134	28.8	-0.61	0.83	87.9
Comoros	0.7	2.4	2	367	-0.2	64.3	0.429	158	46.3	-	-	65
CORAF/WECARD*	**9.1 (6.41)**	**3.46 (0.60)**	**410.2 (526.09)**	**266 (106.59)**	**0.82 (0.97)**	**39.54 (4.84)**	**0.38 (0.06)**	**160 (14.32)**	**27.5 (0)**	**1.47 (1.44)**	**-0.04 (1.00)**	**76.78 (13.70)**
Burkina Faso	15.8	3.4	567	264	1.6	39.6	0.343	153	-	1.35	0.18	81.2
Niger	15.3	3.9	1,267	173	0.1	34	0.304	176	-	0.09	0.19	75.9
Benin	8.9	3.1	111	363	0.9	38.6	0.436	175	-	2.96	1.01	75.3
Liberia	4	4.2	96	148	-0.4	38.2	0.388	149	-	-	0.11	94.8
Gambia	1.7	2.7	10	382	1.9	47.3	0.439	147	27.5	-	-1.71	56.7
CCARDESA*	**14.34 (7.80)**	**2.2 (0.80)**	**580 (512.98)**	**544.8 (443.97)**	**3.68 (2.56)**	**49.28 (7.39)**	**0.43 (0.07)**	**141 (29.48)**	**20.44 (10.89)**	**0.45 (0.77)**	**0.43 (0.87)**	**77.22 (11.02)**
Angola	18.5	2.6	1,247	1,313	7.7	58.6	0.508	172	10.2	0.44	-0.03	70.2
Mozambique	22.9	2.3	786	371	4.6	45.6	0.327	146	31.5	1.48	0.01	81.6
Malawi	15.3	2.8	94	168	1.2	39	0.418	157	30.5	-0.35	1.59	90.5

Zambia	12.9	2.5	743	401	2.7	50.7	0.448	94	21.6	0.21	1.07	81.5
Lesotho	2.1	0.8	30	471	2.2	52.5	0.461	136	8.4	-	-0.51	62.3

Source: World Bank (2011), World Bank (2013), UNDP (2013), Avila and Evenson (undated).
Note: *Average figures for regions, standard deviations in parentheses.Data not available for South Sudan and cases indicated by (-). The share (%) of women participation in agricultural labour force are: Gambia (33%), Niger (36%), Tanzania (48%), Burkina Faso (53%), Zambia (55%), Lesotho (60%) and Mozambique (60%) (FAO, 2011a).

Appendix 3: Key Actors, their Roles and Behaviour

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
Agricultural Research Organizations			
		ASARECA	
Ethiopia	Ethiopian Institute of Agricultural Research (EIAR)	Research on crops, livestock, natural resources and socioeconomics	Accounts for half of Ethiopia's agricultural R&D expenditures and conducts research through decentralized approach comprising a headquarters and 15 research centres across the country (Flaherty et al., 2010b)
	Regional Agricultural Research Institutes (RARIs): Amhara Agricultural Research Institute (ARARI), Tigray Agricultural Research Institute (TARI), Oromiya Agricultural Research Institute (OARI), South Agricultural Research Institute (SARI), Gambella Agricultural Research Institute (GARI), Afar Pastoral Agro-pastoral Research Institute (APARI), Somali Pastoral Agro-pastoral Research Institute (SORPARI)	Research in various regions	
Rwanda	Rwanda Agriculture Board (RAB)	Developing agriculture and animal husbandry through their reform and using modern methods in crop and animal production, research, agricultural extension, education and training of farmers in new technologies.	This is the main agricultural research agency in Rwanda accounting for 73% or total agricultural R&D in the country. Research focus is on crops, livestock, forestry, agroforestry, land conservation, & water management
	Tertiary agricultural education (TAE) Institutions	Teaching, research and extension; under the Ministry of Education	Accounts for 26% of agricultural R&D on crops, livestock, forestry, agroforestry, land conservation, & water management
	Institute for Science & Technology Research (IRST)	Under the Ministry of Education	Accounts for 1% R&D on energy, the environment, health, socioeconomics & postharvest technologies
	Non-profit and for-profit private companies		Accounts for less than 1% of agricultural R&D through collaborations with RAB and TAE in selected thematic areas
	Ministry of Education, Science, Technology and Scientific Research (Centre for Innovation and Technology Transfer – CITT, and Institute for Scientific Research and Technology – IRST)	Promotion of knowledge acquisition, knowledge creation, knowledge transfer and a culture of innovation. Integration of technical education with commerce, industry and private sector (Watkins and Verma, 2008).	
South Sudan	Ministry of Agriculture, Forestry, Cooperatives and Rural Development (MAFCRD)	Agricultural R&D	Minimal research as facilities are ravaged from years of war
	Ministry of Animal Resources and Fisheries (MARF) and the Ministry of Agriculture and Forestry (MAF) both formed in late October 2005	Research policy formulation, coordination, extension	Ensures policy implementation and are already developing new strategic plans for the sector.
Tanzania	Department of Research and Development (DRD)	Overseas 16 agricultural research institutes focusing on agriculture, food security and cooperatives	Accounts for 40% of public agricultural R&D expenditure (Flaherty and Lwezaura, 2010)
	Department of Research, Training and Extension (DRTE)	Livestock and fisheries	Controls 14% of public agricultural R&D
	Commodity-based non-profit organizations (Tanzania Coffee Research Institute – TaCRI; Tobacco Research Institute of Tanzania – TORITA; Tea Research Institute of Tanzania – TRIT)	Research on specific commodities – coffee, tobacco, tea	10% of agricultural R&D expenditure; ad valorem levy funds from farmer produce
	CABI	Has done research to determine the best farmer-led seed production model for African indigenous vegetables in Kenya and Tanzania (EIARD, 2013)	Works in collaboration with the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) and Kenya Agricultural Research Institute (KARI)

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
	Tanzania Forestry Research Institute (TAFORI)	Forests and forest products	These three institutes account for 19% of national research expenditures and 20% of FTE researchers in Tanzania
	Tanzania Fisheries Research Institute (TAFIRI)	Fisheries resources	
	Tropical Pesticide Research Institute (TPRI)	Pesticide production and management	
		CCARDESA	
Angola	Ministry of Agriculture (MINADER)	Coordinates agricultural and advisory services	Operates through the National Food and Nutrition Strategy (Mellor et al., 2010)
	Agronomy Research Institute (IIA) at the Chianga Experimental Research Station	Defines national agricultural research policies; Conducts adaptive and participatory research in cereals, vegetables, fruits, legumes, roots and tubers, fodders, pastures and cotton	The institute receive funding from the state budget, as well as some private institutions and NGOs. Research activity is carried out in an adaptive and participatory way, and technology transfer is undertaken in partnership with the extension service. The main constraints are: • Human resources to intervene in transfer of technology • Infrastructure (experimental stations, laboratories, equipment and vehicles) • Communication resources and information management (library, IT, internet, telephone, parabolic antenna) • Financial resources to implement different programmes
	Veterinary Research Institute (IIV)	Animal science research	Has 8 stations and 6 regional laboratories; The institute receive funding from the state budget, as well as some private institutions and NGOs. Research activity is carried out in an adaptive and participatory way, and technology transfer is undertaken in partnership with the extension service. Does not have an adequate number of technical staff and graduates to undertake a full research programme. The salary scale in IIV is also not sufficient to attract and keep the necessary qualified staff
Mozambique	The Agricultural Research Institute of Mozambique (IIAM) – formed in 2005 by merging four research centres	Main research and development agency,	Accounts for two-thirds of national agricultural research investments and human resource capacity; operates through four technical directorates: Directorate of Agriculture and Natural Resources (DARN), Directorate of Animal Sciences (DCA), Directorate of Training, Documentation and Technology Transfer (DFDTT) and Directorate of Planning, Administration and Finance (DPAF). It also has four Agricultural Research Zonal Centres in various parts of the country; Center for Training and Technical Assistance (CeFAT), Instituto de Fomento do Caju –National Cashew Institute, INcaju,
	Fisheries Research Institute (IIP)	Responsible for all the country's marine and inland fisheries research.	Accounts for 23% of the country's total agricultural research capacity
	The Ministry of Agriculture (MINAG)	Sector policy formulation and coordination	The MINAG, through the DNEA and Provincial Agricultural Extension Services, SPER, has created a good environment to increase the exchange of information and experience among the stakeholders.
	Ministry of Science and Technology	Oversees all research activities in Mozambique; policy formulation	In 2006, the government released the Mozambique Science, Technology, and Innovation Strategy (MOSTIS) to serve as a 10-year framework guiding all science, technology, and innovation efforts at research institutes and universities
Malawi	Department of Agricultural Research (DARS)	Crop and livestock research	
	Cotton Development Trust (CDT)	Research and coordination of cotton value chain	Comprises all cotton and value chain actors
Zambia	International Institute for Tropical Agriculture (IITA)	Conducting agricultural research in maize, cassava and legumes (priority crops for Southern Africa)	The organization was founded in 1967. It is an internationally-funded organization (a member of the CGIAR)
	Zambia Agriculture Research Institute (ZARI)	Provides agricultural services and conduct public good	Public-funded National Agricultural Research Agency established in 1952

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
		as well as farmer demand-driven research in soils, crops, plant protection and farming systems	
	Indaba Agricultural policy research Institute (IAPRI)	Analysis, outreach and capacity building of key sector stakeholders including government (focuses on agricultural economics issues)	Started a project in 1999, became an institute in 2011. non-government nonprofit bilateral/multilateral service provider
	Cotton Development Trust (CDT)	Cotton production research and extension (focus is on plant breeding and agricultural extension research)	Public-funded National Agricultural Research Agency established in 1999
	Central Veterinary Research Institute (CVRI)	Supports livestock disease control and eradication programmes through provision of quality diagnostics services and research activities (focus is on veterinary service/animal medicine)	Public-funded National Agricultural Research Agency established in 1964
CORAF/WECARD			
Burkina Faso	The Environment and Agricultural Research Institute (INERA) – established in 1996	Is the main agricultural research agency. Its mandate is to formulate, implement and coordinate environmental and agricultural research activities in Burkina Faso.	Accounts for about three-quarters of the human and financial resources that the country allocates to R&D (Stads and Kabore, 2010)
	Other government agencies: Applied Science and Technology Research Institute (IRSAT), and National Forest Seed Center (CNSF)	IRSAT deals with Natural resource, agricultural technology and energy, while CNSF produces forest seeds and seedlings, and conducts forestry research.	Account for 20% of national R&D capacity and expenditure
Niger	Niger National Institute of Agricultural Research (INRAN)	Main agricultural agency whose mandate is to promote food security and rural development by conducting research on crops, agronomy, livestock, forestry, aquaculture, fisheries and environmental issues.	Accounts for three-quarters of research capacity and two-thirds of R&D expenditure (Stads et al., 2010)
	Livestock Multiplication Centre (CMB)	Genetic improvement and cattle breeding	17% of R&D expenditures
Benin	Benin National Institute of Agricultural Research (INRAB)	Supports on agriculture and climate change management	Comprises several regional research centres (Centre for Agricultural Research – North, Central, Niaouli, Agonkanmey), Centre for Agricultural Research – cotton and fibre, Centre for Agricultural Research – perennial crops, Centre for Agricultural Research – oil palm, Food Technology Programme Research Centre, Programme for Agricultural Policy Analysis (Moumouni and Idrissou, 2013)
Liberia	Ministry of Agriculture	Coordinates research in crops development and other agricultural commodities	Main focus is crops development, for example through the National Cassava Strategy
Agricultural Education Institutes			
ASARECA			
Ethiopia	Eight higher education institutions (e.g., Haramaya University, Hawassa University, Jimma University, Mekelle University, Ambo University College, Addis Ababa University)	Research on crops, livestock, forestry, fisheries, natural resources	Collaboration between the universities is unclear, may be not structured at organizational level, but occurs randomly at individual levels
Rwanda	National University of Rwanda	Teaching and research	Offers undergraduate programmes in Animal Science, Crop Science, Soil Science and Environmental Management; operates field research stations in livestock, fish-livestock integration, crop production/horticulture and forestry. Has suffered serious staff shortage especially in the first two decades of recovery from the genocide; an active capacity development program has tended to alleviate this constraint, but not fully.
	Umutara Polytechnic Faculty of Agriculture	Teaching and research	Has suffered serious staff shortage especially in the first two decades of recovery from the genocide; an active capacity development program has

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
	Faculty of Veterinary Medicine Faculty of Agriculture Faculty of Technology and ICT Faculty of Business Studies AYEVE Kabatare Agricultural and Veterinary School		tended to alleviate this constraint, but not fully.
Tanzania	Sokoine University of Agriculture	Teaching, research and outreach. Main research areas include crops, livestock, forestry, marine sciences, zoology and botany	Caters for 17% of national agricultural research investment and over 80% of research by higher educational institutes
	University of Dar es Salaam	Teaching, research and outreach. Main research areas include livestock, forestry, fisheries and marine sciences, zoology and botany	Accounts for less than 20% of research by higher education institutes
South Sudan	Juba National University	Are public universities with Faculties of Agriculture	
	John Garang Memorial University		
	Upper Nile University		
	Yei Agricultural and Mechanical University	Private University offering Agricultural Sciences training	
Comoros	Has no university, but has post-secondary agricultural education and training		
CCARDESA			
Angola	Agostino Neto University	Education and Research	Public; One of the key universities offering agricultural courses
Lesotho	National University of Lesotho	Education, research and outreach	Public; has been instrumental in instigating agricultural innovation systems in Lesotho. Through FARA's SCARDA program NUL helped link the ministry, research stations and farmers through Farmer participatory Research
Mozambique	Eduardo Mondlane University (UEM) - Faculty of Agriculture and Forestry	Research in Agronomy, Forestry Engineering and Veterinary Science	Public; the mainly provider of R&D
	Mussa Bin Bique University	Agricultural research	Private
Malawi	Bunda College of Agriculture/University of Malawi (BCA)	Education and research, General agriculture and agricultural economics	Public
Zambia	Co-operative College	Technical College	Public
	Copperbelt University - School of Natural Resources	University – teaching, research and outreach	Public
	Kasaka Fisheries Training Institute	Technical College	Public
	Mpika College of Agriculture	Technical College	Public
	Natural Resources Development College	Technical College, Ministry of Agriculture & Livestock	Offers diploma courses underwritten by the University of Zambia
	Palabana Dairy Training Institute	Technical College	Public
	Popota Tobacco Trainig College	Technical College	Public
	University of Zambia - School of Agriculture	University – teaching, research and outreach	Public and Zambia's premier university; research is conducted by School of Agricultural Sciences (SAS) and the School of Veterinary Medicine (SVM) and other two Schools
	Zambia Centre for Horticultural Training	Technical College	Public
	Zambia College of Agriculture	Technical College	Public
	Zambia Forestry College	Technical College	Public
	Zambia Institute of Animal Health	Technical College	Public
	Mulungushi University	University – teaching, research and outreach	Has a number of collaborative ventures with ANAFE, FARA, foreign universities and other Zambian organizations
CORAF/WECARD			

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
Burkina Faso	University of Ouagadou-gou and Institute for Rural Development (IDR)	Theoretical research training and practical research, respectively, and collaboratively	Provides up to 8% of R&D capacity
Niger	Abdou Moumouni University (UAM)	Agronomy, science and technology	Insufficient infrastructure, human and logistical resources
Benin	Universities of Abomey-Calavi and Parakou	Research on agriculture, food security and climate change vulnerability and adaptation	Uses collaborative regional projects e.g., the project on integrated management of water and nutrients (INuWam) that cover Mali, Niger and Burkina Faso
Lesotho	National University of Lesotho	Offers a degree course in general agriculture, conducts research and undertakes extension activities	The main public university conducting agricultural research; has also been involved in organizing farmer groups for collaborative research.
	Lesotho Agricultural College	Trains in general agriculture	Public funded
	Lesotho Polytechnic	Provides training in irrigation engineering	Public funded
	Farmer training centres	Training of farmers and extension staff	Public funded; has demonstration plots for farmer education
Advisory, Extension and Information Services			
		ASARECA	
Ethiopia	Public Extension Institutions: • Ministry of Agriculture and Rural Development (MOARD) (Agricultural Marketing and Inputs Sector, Natural Resources Sector, Agricultural Development Sector, Agricultural Extension Department, Training and Vocational Education Department) • Ministry of Capacity Building • Ministry of Finance and Economic Development (Food Security Coordination Bureau (FSCB), Ethiopian Agricultural Transformation Agency (ATA)	Policy formulation, extension and advisory services	Quite entrenched extension system with good end-user reach. Currently, extension is mostly provided by the public sector, operating in a decentralized manner where extension is implemented at the woreda (district) level. The public sector is the single most important player, especially in terms of inputs, at the local level for smallholders. The private sector and NGOs (known to have many innovative and participatory approaches), while becoming increasingly important, are often left out of extension initiatives. In Ethiopia, limited extension is conducted by NGOs and the private sector, usually working through the woreda-level BOARDs
	Research-extension advisory councils, and farmer research groups at federal, regional and zone levels	Improve linkages with farmers	
	International NGOs e.g., FARM Africa and Winrock International	Advisory services	
	Local NGOs e.g., Institute of Sustainable Development (ISD) and Sustainable Land Use Forum (SLUF)	Advisory services	
Rwanda	Public extension agencies: • Ministry of Agriculture and Animal Resources (MINAGRI) • Rwanda Agricultural Development Authority (RADA) • Rwanda Animal Resources Development Authority (RARDA) Rwanda Horticulture Development Authority (RHODA) • Rwanda Agricultural Research Institute (ISAR) • Ministry of Local Government (MINALOC) • Department of Regional Development, Research and Extension (DRDRE)	Policy formulation, extension and advisory services	After the 1994 genocide, both national and international NGOs began organizing farmers in groups and associations and providing them with extension advices and services. Most of these NGOs worked in isolation with little or no coordination or sharing of information among them. In order to revamp extension and provide adequate linkages between research, extensions and the various actors in the sector, Rwanda's Ministry of Agriculture (MINAGRI) undertook a restructuring that lead to the creation of Rwanda Agricultural Board (RAB) and the National Agricultural Export Board (NAEB). The recent decision by the Government of Rwanda to decentralize agricultural extension activities to the Ministry of Local Government (MINALOC) aims at addressing efficiently and specific needs of farm households within each district. This move along with a redeployment of staff especially Subject Matter Specialists (SMSs) should strengthen extension and enhance its role by positioning staff closer to the population they are intended to serve
Tanzania	Public Extension Institutions: • Ministry of Agriculture, Food Security, and Cooperatives (MAFC)(Kilimanjaro Agricultural Training Centre (KATC);	Policy formulation, extension and advisory services	For many years, the Ministry of Agriculture has used its staff from the national level down to the field level to implement extension programs. With the decentralization leading to the creation of Local Government Authorities, the

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
	Temeke Municipal Council for County Level Operations) • Ministry of Livestock Development and Fisheries (MLDF) - Department of Research, Training, and Extension (DRTE) • Ministry of Industry, Trade and Marketing (MITM) • Ministry of Water and Irrigation (MoWI) • Prime Minister's Office – Regional Administration and Local Government (PMO-RALG)		Ministry transferred its entire field staff to local government authorities in line with the district focus policy. This transfer reduced the level of involvement of the ministries and the number of technical staff for coordination activities
	Non-Governmental Organizations and other Donors: • Rural Integrated Project Support (RIPs) • INADES-Formation • Uluguru Mountain Agricultural Development Project (UMADEP) a Sokoine University of Agriculture-based project • Special Program on Food Security (SPFS) Hifadhi Mazingira Project (HIMA) • Southern Highlands Dairy Development Project (SHDDP) • Soil Erosion Control and Agroforestry Project (SECAP) • Soil Conservation and Agroforestry Project (SCAPA) • Total land care • Pelum Tanzania • RUCODIA, Ruvuma Commercialization and Diversification of Agriculture	Extension and advisory services	Recently, several NGO and farmer-led initiatives have started to assist public extension in its work with the population. More than 200 NGOs are involved in various types of agricultural extension programs. In addition to NGOs, big donors like Sasakawa Global 2000 and the Rural Integrated Project Support (RIPs) have joined up in capacity building for extension. It is observed that a good number of these NGOs and donors use participatory approaches to extension or a combination of some elements of the Training & Visit (T&V) system with participatory methods
CCARDESA			
Mozambique	PUBLIC: National Directorate for Agricultural Extension (DNEA) and Provincial Agricultural Extension Services (SPER); Instituto Nacional de Investigação Pesqueira (IIP) (in the Ministry of Fisheries); Department of the Rural Extension Directorate (DNER	Dissemination of agrarian technologies, support and capacity building for farmers' organizations, technical assistance to the farmers through training on good agricultural practices, formation and capacity building of farmers, and dissemination of information through various Information Communication Technologies (radio, leaflets, and manuals)	Operate under the Ministry of Agriculture; The MINAG, through the DNEA and Provincial Agricultural Extension Services, SPER, has created a good environment to increase the exchange of information and experience among the stakeholders; partnerships with Sasakawa Africa Fund for Extension (SAFE)
	PRIVATE Joint Venture Companies (JVCs)	Carry out purely commodity extension (e.g. for cotton, tobacco, and cashew). They provide input such as seeds, fertilizers, herbicides and pesticides, and technical advice to farmers. Provide complementary informational extension services to promote the product, to ensure the product's proper use and preserve the firm's market share	Active in input supply; contract to provide technical advises to farmers associations and cooperatives; organizing farmers groups to facilitate export of commercial crops Involves also agro-processing and marketing companies
	NGOs: ACDI-VOCA; CLUSA- the Cooperative League of the USA; Programa de Promoção de Mercados Rurais (PROMER); International Development Enterprises (IDE); World Vision, Food for the Hungry International (Geneva-based NGO); ABIODES (Association for Sustainable Development); Food for the Hungry International (Geneva-based NGO); Kwaedza Simukai Manica (local NGO)	Increased geographic extension coverage and number of farmers reached; promotion participatory learning approaches; formation of farmer and community groups; and promotion of best practices (food security, farmer organizations, market support and agricultural advocacy)	Increasingly gaining in importance; comprise both local and international NGOs
Lesotho	Ministry of Agriculture and Food Security – Field Services Department	Develops and supervises implementation of interventions in agriculture and food security	Operates through a unified extension system (Turner, 2009). There is occasional publication of extension material and regular radio broadcasting of marketing information on prices of produce

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
Zambia	Ministry of Agriculture and Cooperatives	Formulation of extension policies, extension to farmers	Oversight agency; has tended to liberalize the playing field for provision of extension services
	University of Zambia	Research and extension	May engage in research grants that demand partnerships with farmers and farmer-based groups
	Private sector agencies	Extension	Mainly input suppliers
	Farmer based organizations	Extension to members	Organized to reduce transaction costs for members
CORAF/WECARD			
Benin	Public Sector Governmental or ministry-based extension organizations: • Ministère de l'Agriculture, de l'Élevage et de la Pêche, MAEP - Ministry of Agriculture, Livestock and Fisheries, www.gouv.bj • Direction du Conseil Agricole et de la Formation opérationnelle (DICAF) • Central Region for Agricultural Promotion, CePRA Public Research Institutions with Extension Unit University-based Extension	Policy, research and extension	Main supplier of extension services; public extension services mainly supported by donor funds e.g.
	Unit for support to the development of management advisory services (CADG)	Implements advisory services for family farms especially on soil fertility management	Established in 1997 and is a forum for exchange of experiences, reflection on methodologies and discussion of tools for management advisory services
	Support group for management and research on environment and development (GERME)	Supports farmers and their organizations on technical and economic aspects of agriculture through agricultural advisory services	This is an NGO founded in 1998 and supports producers in the use of techniques that form part of integrated soil fertility management in pineapple production in Southern Benin
	African Institute for Application of Development Methods (IAMD-ONG)	Uses advisory services of family farms approach to advise farmers on cotton production techniques and efficient management of their farms	
	Farmer Based Organizations: • Association Interprofessionnelle de Coton (AIC), Cotonou, www.aicbenin.org • Organisation Béninoise pour la Promotion de l'Agriculture Biologique (OBEPAB), Founded: 1995, Gbégamey, www.obepab.bj	Extension and input supplies	Operates an Information Platform to deliver extension along value chains; Farmers and other groups at risk from climate change are active members of early warning (pre-alert) committees established in 35 rural communes in six of Benin's departments. In addition, 60 field schools have been set up, involving some 300 farmers in field tests
	Non-Governmental Organizations: • Centre Béninois pour le Développement des Initiatives à la Base, CBDIBA, Founded: 1990, Bohicon (46 staff in 2009) http://www.cbdiba.org • Groupe d'Appui, d'Encadrement et de Recherche en Milieu Rural, GERME, (8 staff in 2009) • Initiatives pour un Développement Intégré Durable, IDID-ONG (99 staff in 2009) http://ididong.org • Mouvement Rural de Jeunesse Chretienne (14 extension staff in 2009)	Extension and Financial services	
Burkina Faso	Public Sector Extension Services:	Policy, extension and research	

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
	• Ministry of Agriculture, Water and Fishery Resources • Regional Directorate for Agriculture, Water and Fisheries: • Ministère des Ressources Animales, MRA - Laboratoire National d'Élevage, LNE Livestock • Ministère de l'Environnement et du Cadre de Vie, MECV • Ministère de l'Économie et des Finances, MEF • Public Research Institution with Extension Unit - Agency for Promoting Small and Medium-sized Agricultural Enterprises and Handicrafts - APME-2A (15 staff in 2009) • Centre International de Recherche-Développement sur l'Elevage en Zone Subhumide, CIRDES. CIRDES is a subregional research center aiming at improving animal health and productivity. It also aims at the conservation of the species gene pool and at the protecion of the environment. The CIRDES works for the transfert of technologies too. • Institut de l'Environnement et de Recherches Agricoles, INERA • University-based Extension - Université Polytechnique de Bobo-Dioulasso, UPBD ; Institut de Développement Rural, IDR		
	Non-Governmental Organizations • Autre Terre Asbl (6 extension staff in 2009) • Institute Africain pour le Developpement Economique et Social, Centre Africain de Formation, Bureau National du Burkina Faso, INADES (9 extension staff in 2009)		
	Farmer Based Organizations : • ANAR, Association Nationale d'Action Rurale - (6 extension staff in 2009) • Federation Nationale des Organisations Paysannes, FENOP - National Federation of Farmer's Organizations (26 extension staff in 2009) • Federation Nationale des Groupements Naam, FNGN - (95 extension staff in 2009) • Association Munyu des Femmes de la Comoé (no staff information) • Association Nationale des Producteurs de Haricot Ver - ANPHV - National Association for the Production of Green Beans (68 extension staff in 2009) • Cooperative Agricole du Passore - (3 extension staff in 2009)		
Liberia	Ministry of Agriculture	Extension and advisory services	Not effective due to devastated infrastructure and lack of personnel
Producers and Their Organizations			
Burkina Faso	Burkinabe Company for Textile Fibres (SOFITEX) and Nestle	Collaborates with INERA and IRSAT	Generally, no non-profit private companies conduct agricultural research in Burkina Faso

Key Actors	Institutions Involved	Primary Role(s) in NAIS	Remarks on their Behaviours
Benin	Federation of Producers' Unions (FUPRO)	Is the main national umbrella of all agricultural producers' organizations in Benin	Implements projects for support and advise of farmers with technical and financial support from various partners e.g., SNV, Belgian Technical Cooperation
Tanzania	MVIWATA	Network of farmer groups that provide farmer-to-farmer knowledge exchange for agricultural innovations and contracting of agricultural services	Established in 1993 as NGO to represent farmers' interests.
Mozambique	Farmer-based organizations and cooperatives: União Nacional de Camponeses - National Farmers Union, (UNAC); Union of Agricultural Cooperatives of Marracuene (UCAM); Union of Associations and Cooperatives of Lichinga (UCA); Ncachelenga Women's Association; Union of Cooperatives and Associations of Southern Niassa (UCASNE)	The main beneficiaries of public extension services	Only 6.5 percent of Mozambique's smallholder farmers belong to farmer organizations although some districts (Nampula, Zambezia, Manica) have much higher participation rates. Are mainly linked to commodity-based Joint Venture Companies that provide inputs and technical advice, which is extended to members
Ethiopia	Farmer organizations e.g., Ada Lume Cooperative Union	Provides advisory services on durum wheat, chickpea and haricot bean scaling up in Oromiya region	
	Sidam Coffee Farmers Cooperative Union (SCFCU)	Promotes production of *Sidam* coffee	Has 45 primary producer societies
Rwanda	IMBARAGA	A national farmers' association	
	ROPARWA	A national network of farmer organizations and NGOs	
Organizations Providing Support Services to Smallholders			
	Agricultural Promotion Centre (CEPAGRI)	Promotes private involvement in sugar production	This is based on certian incentive structures
Zambia	Ministry of Lands, Natural Resources and Environmental Protection	Land allocation and titling	Tenure system encourages individual investments in agriculture
	Maize Research Institute (MRI)	Maize varieties	
	Zambia Seed Company	Seed varieties	
	Seed Company Zambia (SEEDCO)	Seed varieties and marketing	
Benin	Netherlands Organization for Development (SNV)	Provides capacity building for cotton producer organizations	Development partner organization; extent to which the organization is involved in developing local capacity to ensure sustainability of smallholder support is not very clear
	Benin – Organization for the promotion of organic agriculture in Benin (OBEPAB)	Development of local resources, sustainable agricultural production systems, preservation of the health of producers and consumers, and safeguarding the environment	This is an NGO
	CADG- an NGO	Offers a forum for exchange of experience and tools for management advisory services. It implements advisory services for family farms in collaboration with PADYP	
Mozambique	Joint Venture Companies (JVCs); NGOs	Commodity extension and provision of inputs; promote self-organization of farmers	Active in input supply; contract to provide technical advises to farmers associations and cooperatives; organizing farmers groups to facilitate export of commercial crops Involves also agro-processing and marketing companies
Ethiopia	Private sector companies dealing with input supply and agro-processing	Advisory services on farm inputs and agro-processing	

Appendix 4: Institutional and Political Economy Context for Innovations

	1 = fully agree	**2 =** Agree	**3 =** disagree	**4 =** strongly disagree	**Notes**
A. Wider context influencing policy-making					
A1: National policies focused on smallholders and family farmers development and support their organizations		Mozambique			IIAM strategic plan on decentralization
	Rwanda				First country to sign CAADP compact in 2007; Rwanda Vision 2020; Economic Development and Poverty Reduction Strategy (EDPRS); Strategic Plan for Transformation of Agriculture in Rwanda (PSTA II); Agricultural Sector Investment Plan (ASIP); National Agricultural Export Development Board (NAEB)
		Malawi			Malawi Growth and Development Strategy (MGDS I&II), Agriculture Sector Wide Approach (AsWAP), Farm Input Subsidy Programme (FISP)
		Niger			National Council for Agricultural Research (CNRA); West African Agricultural Productivity Program (WAAPP)
			Lesotho		Existing policies e.g., the National Strategic Development Plan, Agriculture Sector Strategy 2003, the Subsidy Policy 2003, and the Food Security Policy 2005 and the National Agriculture and Food Security Forum all focus on general agriculture, with no emphasis on small family farms development
		Benin			National Strategy for Implementation of Agricultural Advisory Services (SNCA)
		Tanzania			Cooperative Act that facilitates farmer group registration Agricultural Sector Development Strategy (ASDS) *Kilimo Kwanza* -Agriculture First Agricultural Transformation Initiative (ATI)
A2: R&D and innovation policies that promote collaboration, scale-up innovations, encourage private sector investments in research		Rwanda			National Science, Technology and Innovation Policy (NSTIP)
		Zambia			The National Agriculture Policy, The Plant Breeders Rights, Sixth National Development Plan, Strategic Plan for the Ministry of Agriculture and Livestock
		Benin			Policy Statement for Rural Development (LDPDR), Programme for Restructuring Agriculture Sector (PRSA), Policy Statement on Sustainable Development (DPDR), Master Plan for Agricultural and Rural Development (SDDAR), National Agricultural Investment Plan (PNIA) 2010-2015
A3: Producers and other actors involved in defining research and innovation challenges and priorities	Tanzania				MVIWATA
	Benin				FUPRO
	Rwanda				IMBARAGA
			Lesotho		Most technologies e.g., seed production of Open Pollinated Varieties (OPV) are championed by NGOs and donor-funded projects. There is limited involvement of public extension system in innovations
A4: Legal frameworks that facilitate the application of new knowledge from within and/or outside the country		Benin			National Strategy for Implementation of Agricultural Advisory Services (SNCA)
		Liberia			National Policy for Agricultural Extension and Advisory Services. This was developed in July 2012 and focuses on ensuring a pluralistic, decentralized and demand-driven extension system (Republic of Liberia, 2012a)
	Rwanda				National Science, Technology and Innovation Policy (NSTIP)
A5: Policies and legal frameworks that encourage agricultural investments by smallholders (land tenure)		Zambia			Lands Act
	Ethiopia				Policy and Investment Framework (PIF)
		Benin			Promotion of Women in the Agricultural Sector and Rural Development (PPFR)
		Liberia			Liberia Agriculture Sector Investment and Development Programme (LASIP)
		Gambia			Gambia National Agricultural Investment Programme (GNAIP)
	Rwanda				Agriculture Sector Investment Plan (ASIP)
		South Sudan			Agricultural Extension Policy Framework
B. Sector resources, budget allocation mechanisms and public financial management					

	1 = fully agree	**2 =** Agree	**3 =** disagree	**4 =** strongly disagree	**Notes**
B1: Fiscal policies promote agricultural research and development		Tanzania			Annual spending on agricultural R&D is USD$77 million. Percentage of agricultural GDP spent on agricultural R&D is 0.5
		Niger			Total R&D expenditure is USD$6 million. Percentage of agricultural GDP spent on agricultural R&D is 0.25
		Ethiopia			Total R&D expenditure is USD$69.6 million. Percentage of agricultural GDP spent on agricultural R&D is 0.27 in 2008 (much lower that of Kenya at 1.43 for the same year)
		Benin			Total R&D expenditure is USD$22 million.
		Malawi			Total R&D expenditure is USD$21 million.
		Burkina Faso			Total R&D expenditure is USD$19 million.
		Rwanda			Total R&D expenditure is USD$18 million.
		Mozambique			Total R&D expenditure is USD$18 million.
		Zambia			Total R&D expenditure is USD$8 million.
		The Gambia			Total R&D expenditure is USD$3 million.
		Angola			Expenditure on research and extension from 2005-2010 was USD$29 million with USD$5.8 million from Government
B2: Research Grant systems exist that encourage multi-stakeholder R&D	Angola				CIMMYT, IITA, BMGF and HGBF supported drought tolerant maize for Africa innovation project in Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Tanzania, Zambia and Mozambique from 2007 to 2011. Other donors include JICA and University of Hamburg
	Tanzania				From 2007 to 2013: 25% funding on irrigation and food security from the ASDP basket fund (comprising US$90 million loan from the World Bank; and co-funding from African Development Bank, Government of Tanzania, IFAD, EU, Ireland and Japan). Another World Bank grant through the EAAPP provides US$35 million from 2010 to 2015 for regional crop (rice, wheat, cassava) and dairy enterprise development, and to support a regional centre of excellence in rice in Tanzania. Other donors in research include: FAO, DFID, NORAD, SIDA, GTZ/GIZ, Danida, the Millennium Seed Bank project, the Darwin Initiative, the Biodiversity Information Facility. Also received funding from a multidonor trust fund (MDTF) through ASARECA (funds from the European Union, CIDA and DFID) to support research on farmer-led seed production model by CABI scientists in 2010/2011. Other donors include CIMMYT, IITA, ILRI, IRRI, BMGF
	Niger				INRAN's research is fully donor-funded – AGRA, FARA, McKnight Foundation, INTSORMIL CRSP. Others are WAAPP, IFPRI, BMZ
	Ethiopia				ARF, IFAD, IFPRI, BMZ, BMGF, CIMMYT, ILRI, INTSORMIL-CRSP, World Bank
	Benin				- INuWam project on soil fertility management funded by the IDRC -project on better management of small wetlands in Southern Benin for improved food security funded by the START Programme - Other projects are funded by CIMMYT and BMGF
		Lesotho			Support of the design, implementation and evaluation of cash transfers by FAO, UNICEF and DFID at £998,804 from 2011 to 2014. CFC also supported strengthening of productivity and competitiveness of smallholder dairy from 2007 to 2011. Other donors include IFAD, CARE and World Vision
	Malawi				MIRACLE Project on agriculture and nutrition, Farm inputs subsidy, Agriculture and Climate Change Project, Integrated Aquaculture Project. Donors include USAID, DFID, ICLARM, IFPRI, BMZ, IITA. Other initiatives are funded by CIMMYT, BMGF
	Mozambique				Projects on beef production, transforming savanna environment and enhancing food security. Donors include CFC, DFID, BMZ, GART. Others are ICLARM, IFPRI, Future Agriculture Consortium, IRRI
		Zambia			ICLARM, CFC, GART

	1 = fully agree	**2 =** Agree	**3 =** disagree	**4 =** strongly disagree	**Notes**
		Burkina Faso			ILRI, IFPRI, BMZ
		South Sudan			NPA, EC, FAO, World Bank
		Rwanda			SDC, CIDA, FARA, Rockefeller Foundation, BMGF
B3: Policies that encourage technology transfer in agriculture		Benin			National Strategy for Implementation of Agricultural Advisory Services (SNCA)
			Lesotho		The unified extension system has weak monitoring and implementation, and poor motivation of staff. Community-based extension workers do a lot of dissemination work but they are not formally recognized. Farmer training centres have inadequate staff numbers, lack specialized training (most have general agriculture qualifications), inadequate transport and housing facilities
		Liberia			National Seed Policy and Regulatory Framework developed in April 2012 to promote private sector participation in seed development, ensure quality seeds to farmers and oversee registration and certification of seeds (Republic of Liberia, 2012b)
		Rwanda			Crop Intensification Programme by the RADA
B4: Research Grant systems exist that favour smallholders agenda		Tanzania			Zonal Agricultural and Livestock Development Fund (ZARDEF) is a competitive research grant that is co-funded by various contributors and it provides research grants to both public and private zonal agencies that address local stakeholder (including farmer) priorities in crop and livestock issues in the 7 agro-ecological zones.
C. Factors influencing organizational capacity					
C1: Material incentives for sustained performance in the public sector are reasonable – e.g. salary step increase, promotion.		Rwanda, Tanzania	Other countries		Low and stagnating wages for researchers in most countries. Exception are Rwanda and Tanzania where salaries are slightly higher and attractive to expatriate researchers
C2: Non-material incentives are reasonable – e.g., management recognition		Rwanda, Tanzania	Other countries		Working atmosphere is more cohesive and motivating in Rwanda and Tanzania than other countries.
C3: Agricultural trade fairs that showcase innovation, facilitate exchange and business opportunities are in place	Rwanda, South Sudan	Other countries			
C4: Information technology is effectively used in knowledge transfer, access to finance, mentoring and extension services for farming	Rwanda	Other countries			
C5: Staff strengths and competencies in innovation systems actors match policy ambitions.		Rwanda	Other countries		
C6: A performance culture is generally present		Rwanda			Strong work ethics and close monitoring of performance on periodic basis
C7: Front-line rural services providers have the means and relevant autonomy to deliver			All countries reviewed		Poor transport network in most areas. Long chain of authority that delays decision making
D. Networking and relations with critical stakeholders, including development partners					
D1: Major network(s)s, partnerships, mentoring programmes, value chains exist between private companies, producer organizations, NGOs, research, extension and policy organizations integrating smallholders needs.	Rwanda, Tanzania, Ethiopia, Mozambique				National growth corridors established in partnership with private multinational companies under the Grow Africa Initiative
		Zambia - IITA			United States Agency for International Development (USAID), Swedish International Development Agency (SIDA), Consultative Group on International Agricultural Research (CGIAR), ZARI, University of Zambia, Ministry of Agriculture and Livestock

	1 = fully agree	**2 =** Agree	**3 =** disagree	**4 =** strongly disagree	**Notes**
		Zambia - ZARI			Government of the Republic of Zambia, International Fund for Agricultural Development (IFAD), Alliance for Green Revolution in Africa (AGRA) – Bill and Melinda Gates Foundation, FARA
		Zambia - CDT			Government of the Republic of Zambia, Cotton Ginners Association, Cotton Board of Zambia, Common Fund for Commodities, ZARI, Golden Valley Agricultural Research Trust, International Cotton Advisory Committee, Seed Companies (e.g. Seedco, Zambia Seed Company Ltd.), Dunavant
		Zambia - CVRI			FAO, IFAD, Southern African Development Community (SADC), African Union Interafrican Bureau for Animal Resources (AU/IBAR), Government of the Republic of Zambia, International Poultry Association, CTTBD-Malawi, BVI-Botswana, OVI-Republic of South Africa, University of Zambia, SADC
		Benin - INRAB			Research on drought tolerant maize for Africa in collaboration with IITA, International Maize and Wheat Improvement Centre (CIMMYT) and Bill and Melissa Gates Foundation.
		Burkina Faso			FAO and AGORA-led partnership on micro-dose fertilization
D2: Coordinating and/or facilitating mechanism(s) exist to facilitate stakeholder interaction	Rwanda, Tanzania, Zambia	Other countries			Regular roundtable discussions among stakeholders
D3: Smallholders or their representatives (i.e. producer associations) are integrated in activities of the agricultural innovation system(s)		Most countries			Involvement in outreach activities facilitated by extension agents at farm level

Appendix 5: Capacity Assessment Matrix

Dimensions	Capacity areas	Existing situation 'Where are we now?'	Desirable situation 'Where do we want to be?	Capacity Develop. Needs	Interventions 'What is the best way to get there?'	Responsible Actors	Priorities (1=urgent; 4=not a priority)
Enabling Environment	Policy level/regulatory framework to promote inclusive agricultural innovation						
				Rwanda – regulatory agencies such as the Rwanda Bureau of Standards (RBS) and the Rwanda Environment Management Agency (REMA) lack the technical capacity to define and enforce health and environment standards - shortage of technical and vocational skills needed to build and maintain water distribution networks - lack of engineering and technical capacity to explore and drill underground water	Regulatory agencies need greater technical capacity to design and enforce effective food safety and food hygiene standards that do not deter the development of the food-processing industry - establish technical support programmes for vocational training centres that offer certificates and diplomas for water technicians - initiate/review courses in water management and engineering at KIST and NUR	National University of Rwanda (NUR), local technical institutes	1
Organizations	(Effective) Linkages among main actors and especially with smallholders			Rwanda – technical and vocational education and training (TVET) are formulated and taught without input from potential private sector employers. - Design and prototyping of technologies takes place without feedback from clients or potential retailers. Consequently, prototypes fail to get from workshops to end-users.	- TVET schools should start piloting hands-on courses for food technicians, in close consultation with local and regional industry leaders. - design TVET courses in conjunction with technology development and diffusion agencies		1
				Benin – weak linkages between producers' unions, research centres and extension service providers (Wennink and Heemskerk, 2006)	Enhance collaboration and information sharing mechanisms	FUPRO	1
	Curricula of tertiary institutes			Rwanda - Limited practical courses at Universities and Engineering schools - information on value addition	- Establish practical production units that function as microentreprises for dairy and meat processing.	Kigali Institute of Science, Technology and Management (KIST)	1

Dimensions	Capacity areas	Existing situation 'Where are we now?'	Desirable situation 'Where do we want to be?	Capacity Develop. Needs	Interventions 'What is the best way to get there?'	Responsible Actors	Priorities (1=urgent; 4=not a priority)
	Integration of smallholders needs in agricultural innovation			is poorly documented - the agencies responsible for producing technologies (Centre for Innovation and Technology Transfer – CITT, and Institute for Scientific Research and Technology – IRST) focus more on development of new technologies and less on transferring these to small and medium-sized enterprises. - products produced in CITT and IRST are not always efficient or affordable – norms for foundation and registration of potato seed are not adapted to local Rwandese farmers' conditions	- align technical and vocational courses to industry needs by preparing technical manuals in French and Kinyarwanda that codify the in-house expertise of existing value-added enterprises. - establish a technology advisory service to help firms search, acquire and upgrade their technology. - boost technology transfer skills of CITT personnel by initiating specialized training courses in cost-benefit analysis, market value chains and business communication - devise incentives (e.g., better salary, promotion, learning opportunities) for CITT and IRST to focus on the transfer and distribution of appropriate technology, and on prototyping and production. - Transfer the production of foundation seeds to the private sector	Farmer groups and individual farmers	
				Tanzania – weak links between national and grassroots institutions	- enhance linkages with local institutions to represent farmers' voices -form groups and associations beyond production to include value addition activities		1
	Linkages with regional and international innovation organizations	Mozambique - Minimal collaboration between private companies and UEM and IIAM in R&D in Mozambique, but there is effective collaboration with CGIAR centres, RUFORUM, SARRNET					
		Tanzania – many collaborative projects between government or higher education agencies and CGIAR centres on specific commodities/thematic issues; other collaborations involve ASARECA, EAC, Lake Victoria Fisheries Organization, Tea Research					1

Dimensions	Capacity areas	Existing situation 'Where are we now?'	Desirable situation 'Where do we want to be?	Capacity Develop. Needs	Interventions 'What is the best way to get there?'	Responsible Actors	Priorities (1=urgent; 4=not a priority)
		Foundation of Kenya and Tea Research Foundation of Central Africa					
		Rwanda		Low-cost technologies are usually available outside Rwanda, but the technology agencies do not make any effort to search or acquire the technologies for the farmers - lack technical skills in geothermal energy	- Establish an international outreach programme that would link CITT with global counterparts through staff exchanges, staff visits and seminars - establish a technology diffusion trust fund that would finance joint proposals by universities, private firms, research centres, and civil society organizations for technology sourcing, development or distribution projects. - encourage private sector and other organizations besides CITT to participate in technology development and diffusion projects - Institute a hydrogeology course at KIST in collaboration with the Council for Scientific and Industrial Research (CSIR) water laboratory in South Africa to build capacity in underground water assessment - establish an applied geosciences research programme in geothermal resource testing for power generation, testing and drilling underground water resources for drinking, and assessing and mapping mineral resources		1
	Knowledge and information flows in support of innovation systems						

Dimensions	Capacity areas	Existing situation 'Where are we now?'	Desirable situation 'Where do we want to be?	Capacity Develop. Needs	Interventions 'What is the best way to get there?'	Responsible Actors	Priorities (1=urgent; 4=not a priority)
		Rwanda – received support from the World Bank in 2004 to facilitate appointment of a science and technology advisor. Support from the Departmental for International Development (DFID) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) enabled preparation of a concept paper on 'Preparatory National Integrated Innovation Framework for Rwanda'. These development partners also helped in preparation and publication of the National Science, Technology and Innovation Policy.		Farmers and food-processing firms lack adequate awareness of technological options for improving quality and productivity. Farmers and producer cooperatives lack skills for processing their output.	- Create industrial apprenticeships for food science students at local and regional firms. - Industry and local research centres should design joint research programmes to build and utilize applied research and development (R&D) capacity to solve practical problems in food-processing and packaging - establish a training grant facility to support enterprise-based training projects for delivering technical and management course to workers and out-growers.	Competitive research grant systems to local research centres	1
Individual	Skills levels in main organizational actors	Mozambique: total national agricultural FTE is 263. Over 50% of researchers at IIAM are under 40 years old; 9% PhD, 37% MSc. 22% PhD in higher education centres[47]. Less than 30% female researchers at degree level. There is no PhD program offered in local agricultural training institutions. Few in-country MSc. Programs. Insufficient English language knowledge to enable locals to pursue postgraduate training abroad. Research centres have to co-share the limited staff at universities			Training of technicians, and researchers at MSc and PhD levels	Partnership funding between Universities and SIDA, World Bank , FAO already on-going	1
		Burkina Faso: - had 240 FTE researchers by 2008; all have MSc. Qualifications and more than half of them have PhD degrees. About 90% of staff in higher education sector have PhD degrees compared to 40% in research institutes. Postgraduate training in agricultural sciences is available locally. The FTE researcher per farmer ratio is 38 per million farmers.					

[47] Number of agricultural researchers has steadily grown in Mozambique since 2004. By 2008, the country had 263 full time equivalent (FTE) researchers. The research staff is relatively younger, but less well-qualified (in terms of postgraduate degrees) compared to other countries in the Southern Africa region.

Dimensions	Capacity areas	Existing situation 'Where are we now?'	Desirable situation 'Where do we want to be?	Capacity Develop. Needs	Interventions 'What is the best way to get there?'	Responsible Actors	Priorities (1=urgent; 4=not a priority)
		Only 12% agricultural researchers are female.					
		Tanzania – has about 674 FTE agricultural scientists (4% are in commodity-based institutions). Higher education sector contributes 18% of research capacity. Ratio of support staff per researcher increased from 2.1 to 2.7 between 2001 and 2008. FTE researchers per million farmers are 42. About 25% of agricultural researchers have PhD and 47% MSc. Degrees. About 21% of total agricultural researchers are female, 40% of them having BSc. Degrees. 62% and 32% of researchers in higher education have PhD and MSc. degrees compared to 18% and 56%, respectively. A freeze on civil service hiring in 1992 until 2002 followed by massive retirement of many PhD holders led to high proportion of newly recruited less-qualified research staff. There is no major training programme for government-based staff. More researchers (52%) are involved in crop research (mainly maize, cassava and rice) than livestock. In terms of research themes, crop genetic improvement receive a lot of FTE researcher time (17%), followed by crop pest and disease control (9%), livestock pest and disease control (6%), livestock genetic improvement (2%), and others.	Capacity development and retention of highly qualified research staff	Training of newly recruited young researchers tp MSc. and PhD levels			
		Niger – has about 93 FTE researchers, i.e. 23 FTE researchers per million farmers. Only 7% of agricultural researchers are women. Support staff to researcher ratio is 4.1. About 24% of researchers have PhD degrees. High staff turnover in search for better payment elsewhere. A lot of FTE researcher's time is spent on groundnuts (24%) and cowpea (22%).		30 to 50 researchers at PhD level should be recruited by 2025		AGRA and AfricaRice are funding PhD training for INRAN at University of Ghana and UAM (5 researchers on-going)	
		Malawi – has about 180 professional agricultural researchers (but FTE is 127), 17% being female. 20% of the female staff had PhD degrees compared to 35% male staff.					
		Ethiopia – Rural Capacity Building Project (RCBP) focuses on biotechnology training, especially female scientists Ethiopia – about 1,318 FTE agricultural researchers in total.550 at EIAR, 613.3 at the 7 regional agricultural research institutes (RARIs) and 155 in the 8 institutions of higher education by 2008. Ratio of					

Dimensions	Capacity areas	Existing situation 'Where are we now?'	Desirable situation 'Where do we want to be?	Capacity Develop. Needs	Interventions 'What is the best way to get there?'	Responsible Actors	Priorities (1=urgent; 4=not a priority)
		support staff to researchers is 3.3. Number of FTE researchers per million farmers in 2008 was 43. Research staff qualifications: 12% PhD, 35% MSc. and 53% BSc. Only 4% of PhD researchers are female.					
		Rwanda: has 104 FTE agricultural researchers		Agricultural research laboratories lack the capacity to identify research needs of individual farmers or agribusinesses	- develop specialist postgraduate training and skills upgrading programme for research staff - establish a client-led National Agriculture Technology Advisory Board that would review research needs of clients, progress in technology transfer, and the granting of competitive funds to research proposals		
		Angola: Chianga experimental research institute has 10 PhDs, 3 MSc., 14 graduate technicians, 58 mid-level technicians and 350 undergraduate technicians. The Veterinary Research Institute has 3 PhDs, 6 MSc. and 21 basic degree holders			Training of specialists in value-chain development, enhance professionalism in quality control systems and management of agribusiness enterprises		
		Benin: 115 FTE agricultural researchers					
		Zambia: 209 FTE agricultural researchers					
		The Gambia: 38 FTE agricultural researchers					

Appendix 6: Capacity Development Initiatives in ASARECA

Country	Capacity Development focus	Service providers and funders	Stakeholders
Ethiopia	Technology transfer to modernize and increase agricultural productivity	EMBRAPA (Brazilian Agricultural Research Corporation) is the champion from whom EIAR is expected to learn	Smallholder producers
	Enhancing agricultural innovation for development (Africa-Brazil Innovation marketplace)	EMBRAPA and FARA with support from World Bank, DFID, IFAD, BMGF	Smallholder producers
	Promoting adoption of new wheat varieties	EIAR through a grant from USAID (from 2011 – 2014)	Smallholder farmers in Amhara, Oromia, Tigray
	Agricultural market growth	Oxfam Canada	Smallholder producers
	Facilitating farmer participation in agricultural product value chains and rural enterprise development	Mennonite Economic Development Associates	Smallholder producers
	Agricultural growth programme – improving agricultural extension, farmer organizations and input supply systems	CIDA, World Bank (champion)	Farmers and input suppliers
	Participatory development of appropriate technologies through farmer research groups	JICA, OARI, EIAR and two research centres at Melkassa	Farmers and farmer groups
Rwanda	IPs to promote technology diffusion in maize, cassava, potato	DFID and FARA with support from EU	Smallholder farmers

	Strengthening capacity for agricultural research and innovations	DFID, ASARECA, RUFORUM, FARA, Natural Resources Institute of the University of Greenwich, UK	Smallholder farmers, research and training institutes
South Sudan	Livelihoods development project – participatory needs identification and improving agricultural productivity and marketing	IFAD	National and international NGOs
	Technological advancement and improvement of seed varieties	Government of South Sudan, in bilateral agreements with FAO and World Bank, and in collaboration with NARO of Uganda, KARI, and ASARECA	Smallholder producers
Tanzania	Innovative Agricultural Research Initiative – strengthens training and collaborative capacities of Sokoine University of Agriculture and NARIs in Tanzania	USAID	NARIs and education institutes

Appendix 7: Innovations and Capacity Development in Angola

G20 country involved	Initiative on capacity development for agricultural innovation.	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, Thematic Focus	Stakeholders and partners
USA	Drought tolerant maize for Africa (DTMA) Objective: to support the design, implementation and impact evaluation of cash transfers in sub-Saharan Africa	To develop drought maize in Africa	Technological: development of maize varieties	Plant breeding	Target Countries: Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Tanzania, Uganda, Zambia, and Zimbabwe Collaborators: CYMMYT, IITA, BMGF
RDA-South Korea	Improvement of Tolerant maize Varieties to biotic and abiotic conditions			Plant breeding	RDA-South Korea
Japan	Rice culture promotion in Huambo and Bie provinces	objective of improving and release new production technologies of rice; Increase the family income of the populations and alimentary guarantee; Reduction of the unreliability in seeds		Agronomy	JICA
USA	Improvement of the cowpeas and common bean varieties for Angola seed bank constitution	to select the more productive materials, tolerant to the abiotic and biotic factors and rich in proteins and minerals (iron and zinc)	To strengthen institutional capacity for the development and dissemination of improved varieties of common bean	Plant breeding	University of Porto Rico, United States Department for Agriculture (USDA)
Germany	Study of soil and biodiversity of the basin of the OKAVANGO				University of Hamburg
	Improvement of cassava, sweet potato, potato and banana cultures	To select and improve varieties in Uige, Kwanza North, Huambo and Huila Provinces		Plant breeding	CIP, Sonangol and Zero Block
	Soybean promotion	Increase improved seed availability in Huambo and Bie Provinces		Plant breeding	Partnership of CODESPA-Spain and UNDP

Appendix 8: Innovations and Capacity Development Initiatives in Lesotho

G20 Country involved	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Status (Time Frame)	Funding Amount
UK	Cash transfer Programmes	the role of cash transfer programmes in fostering broad-based economic development in sub-Saharan Africa		Malawi, Kenya, Ethiopia, Ghana, Lesotho, and Zimbabwe	FAO Agricultural Development Economics Division (ESA) with UNICEF Eastern and Southern Africa Regional Office (ESARO) and support from the UK Department for	2011-2014	£998,804

					International Development (DFID)		
	Smallholder Dairy improvement	strengthening the productivity and competitiveness of the smallholder Dairy Sector in Lesotho and Zambia	Strengthen capacity of stakeholders	Lesotho, Zambia	GART and CFC as sponsor of the project	2007-2011	€2,470,932
Switzerland	To boost maize and bean seed production and marketing	To establish competitive seed companies Lesotho, Swaziland and Zimbabwe	Training of farmers. So far 66 trained.	Farmers have been given technical support to produce, appropriately grade treat, package and store.	The project is also operating in Swaziland and Zimbabwe. Funded by Swiss Agency for Development		$3,200,000
	Fruit production programme	To create an investor-friendly business climate in Mahobong, Leribe District	Institutional, providing an enabling environment		The World Bank working with the Private Sector Competitiveness Project (PSCP)		€1,620,000

Appendix 9: Innovations and Capacity Development Initiatives in Malawi

G20 Country involved	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Status (Time Frame)	Funding Amount
USA	Drought tolerant maize for Africa (DTMA)	To develop drought maize in Africa	Technological: development of new maize varieties	Target Countries: Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Tanzania, Uganda, Zambia, and Zimbabwe	CYMMIT, IITA, BMGF, HGBF, USAID	2007-2011	
	MIRACLE Project on Agriculture and Nutrition	To improve health and nutrition status, food security and income of people living with HIV and AIDS through the production, consumption and marketing of nutritionally-enhanced crop and livestock products and to lobby for supportive agricultural and health policies, as well as to strengthen the capacity of key stakeholders engaged in agricultural activities.	Improved policies Strengthen capacity of stakeholders in agricultural production	Countries: Malawi, Mozambique, Zambia	USAID Feed the Future, IITA	2011-2013	
UK	Farm input subsidy	To achieve a sustainable increase in agricultural productivity and production in Malawi		Focusing on maize, legumes and dairy	DFID	2011-2015	€32,037,497
	Agriculture and Climate Change	Leaning from experience and early interventions (Case Study Compilation)		Practical case studies of early efforts to develop climate-smart agriculture. Countries: Bolivia, Ethiopia, India, Kenya, Malawi, Nepal, Vietnam and Zambia	CDKN, DFID	2013	
Germany	Enhancing adaptive capacity to climate change impacts through well-managed water use for aquaculture integrated with small-scale irrigation	To enhance the benefits of integrating aquaculture and small-scale irrigation by reducing conflicts over water use and improving capacity for adapting to drought and flood occurrences that are expected to be more frequent in the face of climate change	Integrating aquaculture and small-scale irrigation Improve capacity for adapting to climate change	Target: Chinyanja Triangle (Malawi, Mozambique and Zambia)	ICLARM, BMZ	2010-2013	€1,200,000
	Information services and analyses to address the global food security crisis	To provide timely information and cutting-edge analysis on policy actions for food and nutrition security.	Improved policies	Target Countries: Bangladesh, Brazil, DR Congo, Ethiopia, Guatemala, Haiti, India, Indonesia, Kenya, Malawi,	IFPRI, BMZ	2009-2012	€1,200,000

				Mexico, Mozambique, Niger, Pakistan, Peru, PR China, Sierra Leone, Sudan and Vietnam			
EU	Nutrition and Food Security		Road infrastructure			2008-2013	€258 million
	Grain Traders and Processors Association	To increase and improve livelihoods of smallholder farmers and small scale traders in Malawi through an improved			AGRA Funding	2010-2012	$542,000
	Development of the Malawi Agriculture Commodity Exchange	To enhance incomes to smallholder farmers through provision of market information and trade opportunities.			University of Malawi with AGRA funding.	2009-2010	$250,000
	To improve food security and incomes of smallholder farmers in Malawi	Improve soil fertility and better access to markets			Clinton-Hunter Development Initiative	2010-2013	$720,000
	Improve food security and incomes of smallholder farmers	Improve soil fertility in Malawi			National Smallholder Farmers Association of Malawi with funding from AGRA	2010-2012	$950,000
	To improve smallholder agricultural activity	Train human resource equipped with practical skills	Training of human resource		University of Malawi with funding from AGRA	2010-2012	$366,000
UK	Assessing contribution of the Dairy sector to Economic Growth and Food Security	To address key challenges faced in the dairy supply chain in Malawi			Scottish Agricultural College and University of Malawi with DFID funding	2012-2015	£360,000

Appendix 10: Innovation Projects in Mozambique

G20 Country involved	Initiative on capacity development for agricultural innovation.	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Time Frame	Funding
USA	Drought tolerant maize for Africa (DTMA)	To develop drought maize in Africa	Technological: development of new maize varieties	Target Countries: Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Tanzania, Uganda, Zambia, and Zimbabwe	CYMMIT, IITA, BMGF, HGBF, USAID	2007-2011	
	MIRACLE Project on Agriculture and Nutrition	To improve health and nutrition status, food security and income of people living with HIV and AIDS through the production, consumption and marketing of nutritionally-enhanced crop and livestock products and to lobby for supportive agricultural and health policies, as well as to strengthen the capacity of key stakeholders engaged in agricultural activities.	to strengthen the capacity of key stakeholders engaged in agricultural activities	Countries: Malawi, Mozambique, Zambia	USAID Feed the Future, IITA	2011-2013	
USA	Mozambique Competitiveness and Agribusiness Program (AgriFUTURO)	To increase Mozambique's private sector competitiveness	Strengthening targeted agricultural value chains				

G20 Country involved	Initiative on capacity development for agricultural innovation.	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Time Frame	Funding
			Expand access to financial services				
UK	ProSAVANA	ProSAVANA aims to transform the country's savanah land spreading along the Nacala corridor, drawing on Brazil's own experience in the Cerrado	Strengthen the research capacity by an injection of materials and human resources		Future Agricultures Consortium, DFID, Brazil and China		
	Improve beef production in Mozambique and Zambia	To improve the quality of beef		Target countries: Mozambique and Zambia	CFC, GART	2011-2015	€1,200,000
Germany	Enhancing adaptive capacity to climate change impacts through well-managed water use for aquaculture integrated with small-scale irrigation	To enhance the benefits of integrating aquaculture and small-scale irrigation by reducing conflicts over water use and improving capacity for adapting to drought and flood occurrences that are expected to be more frequent in the face of climate change	Integrating aquaculture and small-scale irrigation Improve capacity for adapting to climate change	Target: Chinyanja Triangle (Malawi, Mozambique and Zambia)	ICLARM, BMZ	2010-2013	€1,200,000
	QTL's to Variety: pyramiding major drought-responsive QTLs for sustainable rice yields	To enhance food productivity, food security, and livelihood in drought prone areas.		Countries involved: India, Mozambique, Nepal, Philippines and Tanzania	IRRI, BMZ	2011-2013	€1,200,000
	Accelerating poverty reduction by maximizing the impact of social services expenditures on agricultural labour productivity and incomes	To improve the understanding among decision makers of the conditions under which public expenditures on social services can yield the highest impact on labour productivity and incomes in rural areas and thereby help accelerate the achievement of the MDG 1 poverty target in a larger number of countries.		Countries involved: Burkina Faso, Mozambique and Tanzania	IFPRI, BMZ	2010-2012	€1,200,000
	Information services and analyses to address the global food security crisis	To provide timely information and cutting-edge analysis on policy actions for food and nutrition security.	Policy analysis	Target Countries: Bangladesh, Brazil, DR Congo, Ethiopia, Guatemala, Haiti, India, Indonesia, Kenya, Malawi, Mexico, Mozambique, Niger, Pakistan, Peru, PR China, Sierra Leone, Sudan and Vietnam	IFPRI, BMZ	2009-2012	€1,200,000
	Supporting the vulnerable: increasing the adaptive capacity of agro-pastoralists to climate change in West and Southern Africa using a trans-disciplinary research approach (CLIMATE CHANGE)	To increase the adaptive capacity of agro-pastoralists, who are one of the most vulnerable groups in Africa, to climate variability and the expected effects of future climate change.	Co-generate methods, information and solutions between local communities	Target countries: Kenya, Mali and Mozambique	ILRI, BMZ	2008-2011	€870,000
	Safe food, fair food: Building capacity to improve the safety of animal-source foods and ensure continued market access for poor farmers in sub-Saharan Africa	To contribute to poverty alleviation by protecting both the health of low-income consumers and livestock-based livelihoods of the poor through improved food safety of livestock products in domestic markets in East, West and Southern Africa	Through workshops to influence policy	Target countries: Ethiopia, Ghana, Kenya, Mali, Mozambique, Tanzania	ILRI, BMZ	2008-2012	€1,049,928
	Innovative Finance	Loans to small-scale farmers in Mozambique	Improve financial capacity of farmers		Standard Bank, AGRA and	2009-	$25,000,000

G20 Country involved	Initiative on capacity development for agricultural innovation.	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Time Frame	Funding
					Millennium Challenge Account		
	Improve food security and increase incomes of smallholder farmers in Zambezia and Nampula Provinces	Promotion of Integrated Soil fertility Management			IIAM with AGRA funding	2009-2012	$435,000

G20 Country involved	Initiative (Project) on capacity development for agricultural innovation.	Stakeholders and Partners	Goal/Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, targets	Stakeholders and partners	Time frame	Funding amount
Australia	SIMILESA: Sustainable Intensification of Maize-Legume cropping systems for food Security in Eastern and Southern Africa Program	Australian Centre Forwards International Agricultural Research (ACIAR); University of Queensland:; QAAFI CIMMYT; Mozambique Agricultural Research Institute (IIAM); Seed companies; Farmes' associations, Instituto Superior Politecnico de Masnica (ISPM); Extension Service at District Level	Conservation Agriculture on Maize and Legume Systems in districts of Angonia; Manica; Ssussundenga; and Gorongosa	Technological capacity development through the development of agronomic technologies	-To characterize maize and legume production and input and output value chain systems and impact pathways, and identify broad systematic constraints and options for field testing; - To test and develop productive, resilient and sustainable smallholder maize-legume cropping system and innovation systems for local scaling out; -To increase the range of maize and legume varieties available for smallholders through accelerated breeding, regional testing and release, and availability of performance data; -To support the development of regional and local innovation systems -Capacity building to increase the efficiency of agricultural research today and in the future	Agricultural Research Council (ARC); ICRISAT; Murdoch University. A part from Mozambique there are 4 countries involved namely, Tanzania, Malawi; Kenya and Ethiopia.		

G20 Country involved	Initiative (Project) on capacity development for agricultural innovation.	Stakeholders and Partners	Goal/Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, targets	Stakeholders and partners	Time frame	Funding amount
China	Centre for Demonstration of Agricultural Technology China-Mozambique	Ministry of Agriculture (Agricultural Research Institute-IIAM); Ministry of Science and Technology	The Demonstration Centre is based in Umbeluzi ,Boane District in Maputo province. The main crops tested and available within the demonstration Centre are: maize, cotton; vegetables (onion, cabbage, tomato etc)	Training of farmers in different technologies	Insure that technologies developed in China as well as in Mozambique are transferred to farmers, extension works, and students trough demonstration farms and training in order to increase agricultural productivity in Mozambique	Hubei Agricultural University; Hubei Lianfeng Desenvolvimento Agricola Ultramarina Co.Lda		
UK	Testing REDD+: Technological solutions to increase agriculture productivity and efficient biomass energy in the Beira Corridor	Agricultural Research Institute of Mozambique (IIAM), International Institute for Environment and Development (IIED)	IIAM Center Zonal Center		Outcome: Testing REDD+: Technological solutions to increase agriculture productivity and efficient biomass energy in the Beira Corridor;		15/03/2013 to 31/12 2014	£16,160
Germany	African Cashew initiative (ACi) – A search for resistance in cashew powdery mildew pathosystem	Agricultural Research Institute of Mozambique (IIAM), Deutsche Geselleschaft Fur InternationaleZusammenarbeit (GIZ)	IIAM North East Zonal Center, NAmpula-Nassuruma area	Training in use of modern technologies	Outcome: Cashew cultivars that are tolerant or resistant to powdery mildew ranked by molecular tools and one Mozambican trained in using this modern technologies for the benefit of our cashew industry		2 years	€90,840
Brazil/EU	Technical Support Project For Agriculture and Livestock Innovation Platform In Mozambique	Ministry of Agriculture (Agricultural Research Institute-IIAM); Brazilian Agriculture Research Cooperation "EMBRAPA";Brazilian Cooperation Agency ABC; United States Agency for International Development (USAID)	The all country ; IIAM Head quarter and IIAM research centers	Strengthen national agricultural system in Mozambique, aiming at optimizing planning, coordination , monitoring and assessment of actions regarding agricultural research, and dissemination of technologies	Management, monitoring and assessment of agricultural research; Establish Seed System, land management and communication and information system for technology transfer			

G20 Country involved	Initiative (Project) on capacity development for agricultural innovation.	Stakeholders and Partners	Goal/Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, targets	Stakeholders and partners	Time frame	Funding amount
Mozambique	Genetic and phenotypic characterization, multiplication and conservation (*In-Situ* and *Ex-Situ*) of native cattle breeds of Mozambique for their sustainable use and development	IIAM, farmers, Faculty of Veterinary medicine – UEM, ILRI and ARC	countrywide		Goal: The general objective of the present proposal is to increase productivity of native cattle breeds and promote their development and sustainable Thematic focus: phenotypic and molecular studies in cattle. Target: native cattle in smallholder and commercial farmers. use., $50,000	Agreement between IIAM and ARC, Irene for collaboration, memorandum of understanding underway. Introduction to provincial livestock sector about the project.		
Finland	Forest Research Capacity Strengthening in Mozambique	Forest Research Institute of Finland (METLA), Ministry of Foreign Affairs of Finland, IIAM, Directorate of Land and Forest - Ministry of Agriculture of Mozambique (MINAG) and Eduardo Mondlane University – Faculty of Agronomy (UEM-FAEF)	Countrywide		Goal: Strengthened capacity of IIAM and UEM-FAEF to conduct applied research applicable to local stakeholders, aiming at sustainable forest management in the use of natural forests	MoU between Metla, IIAM and UEM-FAEF; Forest Department of MINAG	2012	€1,000,000.00

Appendix 11: Summary of Capacity Development Initiatives in Mozambique

Capacity Development focus areas	Donors	Stakeholders
Policy and institutional CD on access to production resources, technologies and markets	IFAD	Smallholder farmers, artisanal fishers, FAO, IFAD, World Food Programme (WFP)
Policy, institutional and individual CD to strengthen local government ability to manage agricultural service delivery, and offer direct support to farmers	World Bank	Smallholder farmers in the Zambezi region
Institutional and individual CD on agriculture enterprise development, savings, credit and community mobilization	CIDA through Agha Khan Foundation	Farmers in Cabo Delgado province
Policy, institutional and individual CD on knowledge and skills in production, sustainable land and water management, market access	CIDA through ACORD	Smallholder farmers and pastoralists in SSA
Institutional research and extension	CIDA through CIAT	Rural populations
Institutional, policy and individual CD in various production and research projects	SIDA	Rural populations
Institutional and policy CD through a new programme – Mozambique Policy Analysis and Planning Capacity for Improved Food Security and Nutrition Outcomes	USAID funding through Michigan State University as the champion	Local organizations

Institutional CD on the Mozambique Science, Technology and Innovation Strategy	World Bank, IFAD, Rockefeller Foundation, BMGF, EU, Australia, Canada, Finland, USAID, The Netherlands, DANIDA, SIDA	Agricultural research institutes and Universities
Tropical Savannah Agriculture Development Programme for Improving Research and Technology Transfer Capacity for Nacala Corridor Agriculture Development (2011-2015)	IIAM, EMBRAPA, JIRCAS	Mozambican bean farmers
Institutional, policy and individual CD – Mozambique platform for agricultural research and technology innovation that supports seed enterprises, agro-input dealers and fertilizer development; strengthens communication and extension systems; advocates for policy change; builds capacity for research and technology transfer	USAID – champion. Other collaborators are CIMMYT, IITA, CIP, CIAT, IFPRI, ILRI, IRRI, IFDC, EMBRAPA, ICRISAT, Mozambique Government	Researchers, traders and extension systems

Appendix 12: Innovation Projects in Zambia

G20 Country involved	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Time Frame	Funding
USA	Drought tolerant maize for Africa (DTMA)	To develop drought maize in Africa	Technological: development of new maize varieties	Target Countries: Angola, Benin, Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Tanzania, Uganda, Zambia, and Zimbabwe	CYMMIT, IITA, BMGF, HGBF, USAID	2007-2011	
	MIRACLE Project on Agriculture and Nutrition	To improve health and nutrition status, food security and income of people living with HIV and AIDS through the production, consumption and marketing of nutritionally-enhanced crop and livestock products and to lobby for supportive agricultural and health policies, as well as to strengthen the capacity of key stakeholders engaged in agricultural activities.	to strengthen the capacity of key stakeholders engaged in agricultural activities	Countries: Malawi, Mozambique, Zambia	USAID Feed the Future, IITA	2011-2013	
	Fertilizer use and liming recommendations for sustainable crop production in smallholder agriculture in Zambia			Geographical location: Eastern, Southern, Northern and Central Provinces	Farmers, Fertilizer companies, Extension, Universities, USA		$458,933
	Integrating grain legumes in maize based systems for improved soil health, food security and incomes by smallholder farmers in Zambia			Geographical location: Eastern, Southern, Northern and Central Provinces	USA		
	Support an on-going learning process through collection of data on framework conditions of the cotton sector, qualitative data through focus groups, and quantitative data from small monitoring surveys (NORC)			Geographical location: Petauke, Chipata and Sinazongwe districts			$88,015
	Impact of Hybrid maize seed use inZambia			Sinazongwe and Petauke districts	USA		$100,000

G20 Country involved	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Time Frame	Funding
	Increased utilization of sorghum through product development and entrepreneurship training	Product development training on sorghum based products	Training	Siavonga district	UNZA, Ministry of Agriculture and Livestock, University of Nebraska-Lincoln	2008-2012	
	Increased utilization of cowpea for improved health	Determination of phenolic content, condensed tannins and anti-oxidant activity in different cowpea varieties		ZARI, MAL, National Food and Nutrition Commission (NFNC), Universities of Pretoria and Texas A&M, and Ergeton University			
	Development and promotion of rice blast resistant and soil acidity tolerant upland rice varieties for sustainable food security, nutrition and household incomes in Zambia			Geographical location: western, Eastern and Northern provinces	USA		$185,000
EU	Promotion of Micronutrient Dense Beans targeting the sick, women and children			Northern and Eastern provinces	USA		$20,000
	To strengthen the potential and sustainability of rainfed agriculture in Africa (WAHARA)	Training			GART, ALTERRA, University of Leeds, Metameta Research of The Netherlands, Institut De L'enviro. Et.De Researches, Mekelle University in Ethiopia and Wageningen University of the Netherlands		€2,619,115.28
China	Chines Agricultural Technology Demonstration Center (ATDC)	To train small scale farmers in new technologies	Training of farmers	Zambia	China, Government of Zambia, UNZA		
UK	Agriculture and Climate Change	Learning from experience and early interventions (Case Study Compilation)		Practical case studies of early efforts to develop climate-smart agriculture. Countries: Bolivia, Ethiopia, India, Kenya, Malawi, Nepal, Vietnam and Zambia	CDKN, DFID	2013	
	Conservation Agriculture innovation platform	To improve farmers' practice	Training of farmers	In Monze and Chipata in Zambia	DFID, RIU	2009-2010	
Japan	The Food Crop Diversification Support Project (FoDiS)	To enhance food security by promoting drought tolerant crops			JICA, ZARI	Current	
	Vulnerability and Resilience of social-ecological systems			Petauke and Sinazongwe	Japan		$89,648 per year
	Improved beef production in Mozambique and Zambia	To improve the quality of beef			CFC, GART, Governments of Mozambique and Zambia	2011-2015	€1,200,000
	Strengthening the productivity and competitiveness of the smallholder				CFC	2007-2011	€2,470,932

G20 Country involved	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, thematic focus, target	Stakeholders and partners	Time Frame	Funding
	Dairy sector in Lesotho and Zambia						
Germany	Strengthening aquatic resource governance: institutional innovation to build livelihood security and reduce conflict in the Lake Victoria, Lake Kariba, and Tonle Sap/Lower Mekong eco-regions	To strengthen the capacity for collaboration among producer organizations and other civil society groups, governments, and private sectors to address the sources of resource competition, and develop governance arrangements that manage future resource competition equitably	strengthen the capacity for collaboration among producer organizations	Countries: Cambodia, Uganda, Zambia and Zimabwe	WorldFish Center (ICLARM), BMZ	2011-2014	€1,200,000
	Enhancing adaptive capacity to climate change impacts through well-managed water use for aquaculture integrated with small-scale irrigation	To enhance the benefits of integrating aquaculture and small-scale irrigation by reducing conflicts over water use and improving capacity for adapting to drought and flood occurrences that are expected to be more frequent in the face of climate change	Integrating aquaculture and small-scale irrigation Improve capacity for adapting to climate change	Target: Chinyanja Triangle (Malawi, Mozambique and Zambia)	WorldFish Center (ICLARM), BMZ	2010-2013	€1,200,000
	Working together for market access strengthening rural producer organizations in Sub-Saharan Africa	To improve the lives of the smallholder farmers by strengthening the ability of RPOs to improve their members' access to imput and output markets		Target Countries: Senegal, Uganda and Zambia	IFPRI, BMZ	2009-2012	€1,176,000
	Yambeeji Honey and Rice Products Outgrower scheme	Improve quality of Rice and increase production	Training farmers on improving rice quality	Farmers are supplied with inputs and are linked to markets	ZARI		
USA	UNZA Cowpeas Utilization project	Increasing cowpeas utilization to promote health and food security	Some staff training		Dry Grain Pulses Collaborative Research Support Program (CRSP), ZARI	2010-2013	$65,000
IAEA	UNZA maize variety improvement	development of Maize genotypes for drought and low fertilizer (N&P tolerance)	Infrastructure (equipment)		Plant and Soil Science departments	2012-2016	$250,000
	To improve agricultural productivity	Train human resource equipped with practical skills in soil fertility management	Training of human resource		University of Zambia with funding from AGRA	2011-2013	$350,000
	To improve agricultural productivity	Train human resource equipped with practical skills in breeding and seed systems	Training of human resource		University of Zambia with funding from AGRA	2011-2013	$450,000

Appendix 13: Regional capacity Development Initiatives in CCARDESA

Name of G20 Country	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, Thematic Focus	Stakeholders and partners	Status (Time frame)	Funding Amount
EU	To improve regional research and contribute to SADC rural development	Enhance the national efforts in order to improve incomes of small-scale farmers, processors, traders and other beneficiaries.	Improve institutional capacity of the NARS	Establish networks, implement competitive fund system and strengthen scholarship fund among	Regional NARS and other international Research bodies	2006-2010	€15 million

Name of G20 Country	Initiative on capacity development for agricultural innovation	Goal /Area of Interest (Geographical or Interest)	Capacity Development Component	Activities, Thematic Focus	Stakeholders and partners	Status (Time frame)	Funding Amount
				others.			
EU	Land and Water Management Applied Research Programme	Increase the availability of improved and appropriate land and water management technologies to research and development institutions in SADC for subsequent dissemination to farmers.	Professional skills improved through training and information sharing	Increase the capacity and productivity of research teams in the SADC region	Regional NARS	Ended 2008	
UK	Strengthening Capacity in Agricultural Research and Development in Africa (SCARDA) Programme	To strengthen institutional and human capacity of the NARS	Strengthening the competencies and capacity in agricultural research management and strengthening capacity for professional development in agricultural research and development		National NARS	2008-2011	$150,000

Appendix 14: Capacity Development Initiatives in Burkina Faso

Initiative on CD	Goal	Thematic focus	Focus of the CD	Partners	Timeframe	Funding (US$)	Funding source (G20 countries)
1.Strengthening Adaptation Capacities and Reducing the Vulnerability to Climate Change in Burkina Faso http://www.undp-alm.org	To enhance Burkina Faso's resilience and adaptation capacity to climate change risks in the agro--pastoral sector	Climate Risk, Management	Institution capacity development	GEF AND FAMERS Implementer: UNDP	2009- 2013	23,094,595	USA GEF/LDCF , World Bank –
2. Building capacity of women in sustainable agriculture, conservation, savings/credit, and management http://www.umcor.org	To improve the livelihoods of the targeted communities through the promotion of productive and sustainable resource management practices that are socio-economically viable	Agriculture, conservation, savings/credit	Individuals capacity development	Implementer UMCOR Manni and Coalla, in Gnagna province Gnagna province Farmers,	2012-2013	183,441.00	UMCOR
3.Development of Export-oriented Sesame Production & Processing in Burkina Faso http://www.common-fund.org	To increase income and alleviate poverty of smallholder sesame farmers in Burkina Faso through improved production and processing of sesame seed and improvement of the position of small producers in the value chain	Production and processing of sesame	Individuals capacity development	Mali, FAO, Farmers Implementer: Royal Tropical Institute (KIT)	2012-2013	60,000	CFC
4. Development of a national capacity for rural innovation in Burkina Faso. http://www.icra-edu.org	To build capacity of community organizations and extending partnerships to less "conventional" ones more involved upstream and downstream market chains.	Agriculture training	Community/farmer organisations	IFAD, IFDC, Ouagadougou University, Super-Agro Montpellier, Inter-Mondes ASBL. Implementer: IFDC	2006- 2013	N/A	France, Belgium Switzerland, United Kingdom through ICRA.

5. Capacity Building for Rural Development and Sustainable Land and Forestry Management. http://www.worldbank.org	To strengthen the hands of rural communities as they take actions to protect the resource base while increasing incomes and food production	Agriculture, Forestry	Individuals capacity development	IDA, GEF Implementer: Burkina Faso Government	2010-2013	7,410,000	USA, GEF Trust Fund
6. Strengthening the rural communities to build healthy farming and food system from bottom up well International http://www.ifdc.org	To promote sustainable farming and livelihood strategies to ensure the food security of poor farm families	Raising awareness	Individuals capacity development	Ground well International, community-based organizations (CBO), NGOs, Development Actors Implementer: IFDC	2010-2013	N/A	USA
7. Professionalization of Agro-Input Dealers in Burkina Faso	Assisting farmers in the country to gain better access to high-quality agro-inputs	Agro-input market	Individuals capacity development	Association of Agro-Input Wholesalers and Retailers	2011-2014	N/A	AGRA
8.Research for Life's AGORA programme http://www.ifdc.org	To support Burkina Faso's researchers Develop Innovative Agricultural solution	Free access to the world 's scientific literature in agriculture,	Institution capacity development	United Nations agencies , universities , and Microsoft , FAO Implementer: IFDC	2003-0n going	N/A	USA
9.Participatory Natural Resource Management and Rural Development Project in the North, Centre-North and East Regions (Neer-tamba Project) http://www.fao.org	To improve the living conditions and incomes of almost 200,000 rural households that are among the poorest in Burkina Faso, enabling them to increase their autonomy and expand their role in building economic and social sustainability.	Strengthening resilience to climate change at the household, farm and village levels through sustainable land development , Intensifying small-scale farmers' production capacity through the dissemination of best practices and the promotion of financing and innovation	Individuals capacity development	Italy, Implementer: IFAD	0n going	110 2 00.000	IFAD
10. Rural Business Development Services Programme http://operations.ifad.org	To contribute to the poverty reduction in rural area by developing local private sector	Support generating income activities and transform it in micro – enterprise and increase the profit	Private sector	Implementer: *IFAD*	2010 - 2016	25 2 00,000	*IFAD* , West African Development Bank (BOAD)
12.Small-Scale Irrigation and Water Management Project. http://operations.ifad.org	To contribute to rural poverty reduction and improving the food Security	Irrigation and water management	Individuals capacity development	Ministry agriculture, Implementer::IFAD	2008 - 2014	19 100 000	IFAD , OPEC, FID
13.Agricultural Commodity Chain Support Project http://operations.ifad.org	Decrease rural poverty and improve their livelihood	Capacity building	Institution, individual capacity development	Ministry agriculture, Implementer :IFAD	2005 - 2013	16 900 000	IFAD
14.Sustainable Rural Development Programme http://operations.ifad.org	Support the rural population to strengthen their planning, organization, and land resources capacity	Capacity strengthening	Individual capacity development	Ministry agriculture, Implementer :IFAD	2007 - 2013	16000 000	IFAD

Appendix 15: Capacity Development Initiatives in The Gambia

Initiative on CDAI	Goal	Thematic focus	Focus of the CD	Partners	Timeframe	Funding (US$)	Funding source (G20 countries)
1.National Agricultural Land and Water Management Development Project (Nema) http://www.ifad.org	To reduce the poverty of rural women and youth	Agricultural market and commercialization	Institution capacity development	IFAD, Islamic Development Bank, development partners, Farmers, service provider and operators, small and medium enterprises Implementer: IFAD	2012 - 2019	65 000,000	Belgian through IFAD
2.Vegetable Production Group Guidance Project. www.icdf.org	To establish a model for cultivation and management at vegetable farms, including crop rotation systems	Production techniques, disease management and infrastructure maintenance	Policy capacity development	Taiwan Technical Mission in the Republic of The Gambia, Ministry of Agriculture, NARI ,Gardening Division, Department of Agriculture, Farmers Implementer: IFAD	2011-2013	1,100,000	USA through IFDC
3.Community-Based Forestry Management Programme http://www.unesco.org	To stimulate collective attitudinal changes towards natural resources in order to promote sustainable environmental conservation;	Training and support Farmers to establish income generation (in, for example, handicraft production; beekeeping; cash crop production.	Individuals capacity development	UNESCO, UNESCO, World Bank, local NGOs National Consultancy on Forestry, Extension Services and Training (NACO), Fight Against Social and Economic Exclusion (FASE), the National Beekeepers' Association of the Gambia (NBAG) and the Jamorai Timber and Firewood Federation (JATIFIF).Implementer: The government of the Gambia (through the Forestry Department)	2009-2013	N/A	Germany , USA
4.Achieving sustainable Cowpea production https://extranet.fao.org	To assist rural households to achieve sustainable Cowpea production	Train Women Farmers in Integrated Production and Pest Management Practices in Farmer Field Schools	Individuals capacity development	FAO, NARS, Farmers Implementer: FAO	2012-2014	290,323	USA
5.Food & Agriculture Sector Development Project (FASDEP) - Gambia http://www.afdb.org	To reduce rural household poverty, through efficient use of arable land and water resources for agricultural production and productivity.	Agriculture and infrastructure capacity development	Individuals capacity development	ADB Implementer: Department of state from agriculture	2012-2015	520,492	African development bank Group
6.Action Aid The Gambia http://www.actionaid.org/gambia	To Support the basic rights and needs of poor people, working at a practical level to improve their access to service	Agriculture and advisory services capacity development	Individuals capacity development	National women Farmers association, Action Aide, small holder Farmers, Telecommunication companies Implementer :action aid	N/A	N/A	United Kingdom
7.Improving food security through crop production intensification and school feeding program https://www.devex.com	To increase household food security and the incomes of participating farmers;	Crop Production Enhancement and Marketing and School Feeding Program	Individuals capacity development	FAO, NARS, Farmers Implementer: Government of Gambia	2013-2015	5,501,332	EU

8.Livestock and Horticulture Development Project: http://operations.ifad.org	To help small-scale rural producers, who are mainly women, to increase their incomes by improving the yield and quality of their horticultural and livestock products.	Rehabilitating and modernizing kafo-run production units with sheds, animal housing, multi-purpose water-use systems and fencing, Training, Strengthening the marketing capacity of *kafos* for identifying and negotiating contracts with traders and suppliers.	Individuals capacity development	IFAD, AfDF, the National Women Farmers' Association (NAWFA). Implementer: IFAD	2010 - 2015	15 9 00 000	IFDC and AfDF
9.Rural Finance Project http://www.ruralpovertyportal.org	To help strengthen and consolidate existing microfinance institutions in The Gambia, enabling them to deliver financial services to economically active poor rural people.	Financial services	Institution capacity development	IFAD, AfDF, the National Women Farmers' Association (NAWFA) Implementer: Government of Gambia	2008 - 2014	7 900 000	IFDC and AfDF
10.Participatory Integrated-Watershed Management Project http://operations.ifad.org	To empowers poor communities in rural areas to undertake and maintain integrated watershed management activities, with the aim of increasing their incomes and protecting their natural resources	Strengthening the capacity of rural communities and their service providers to manage the watershed sustainably and Providing the resources that local communities need to implement watershed management plans.	Individuals capacity development	IFAD, AfDF, the National Women Farmers' Association (NAWFA) Implementer: IFAD	2006 - 2014	17 500 000	IFDC and AfDF

Appendix 16: Capacity Development Initiatives in Niger

Initiative on CD	Goal	Thematic focus	Partners	Focus of the CD	Timeframe	Funding (US$)	Funding source (G20 countries)
1.Cowpea value chain development in Niger: An integrated process of capacity building http://www.snvworld.org	To create enabling conditions for the emergence of competitive agricultural value chains	Agriculture processing	Producers' groups cooperatives, artisans, associations, federations, SMEs, Economic Interest Groups (EIGs), Regional Artisans' Federation of Zinder (FRAZI). advisory service providers (NGO, associations, EIG) Implementer: Government of Niger	Policy capacity development	2009-2013	38,000	Netherlands, -USA through SNV
Agricultural and Rural Rehabilitation and Development Initiative Project – Institutional Strengthening Component (ARRDI-ISC) http://operations.ifad.org	To Reduce poverty by improving the access of all citizens to good local governance and services.	capacities building	Approved DSF, World Bank, Global Environmental Facility Implementer: IFAD	Institution capacity development	2009 - 2013	61.5 million	IFAD, Approved DSF, World Bank, Global Environmental Facility
3. Promotion of post-harvest technologies in the storage and processing of maize and cowpea to	To ensure efficient post-harvest technologies systems in West and Central Africa	Post-harvest technologies	FAO, NARS, Farmers Implementer: Niger through National agriculture research	Institution capacity development	2011-2013	450,000	USA through USAD

Initiative on CD	Goal	Thematic focus	Partners	Focus of the CD	Timeframe	Funding (US$)	Funding source (G20 countries)
reduce losses and to improve market http://www.coraf.org			institution of Niger				
4.Agriculture Intensification through Reinforcement of the Inputs Co-operative Shops http://operations.ifad.org	To enhance the food security of vulnerable populations by improving crop yields (millet and sorghum and market garden crops) through the controlled use of fertilizers.	Fertilizers	FAO, NARS, Farmers Implementer: IFAD	Farmer's organizations	2008-2013	7,009,395	World bank
5. Ruwanmu Small-Scale Irrigation Project. http://operations.ifad.org	To raise the incomes and improve the food security of 65,000 rural households located within 30 communes in the Maradi, Tahoua and Zinder regions of Niger	Strengthened local capacity to manage water resources, marketing, small-scale irrigation.	IFDC, Government of Niger Implementer: IFAD	Individual capacity development	2013 - 2018	25 700 000	IFDC
4. Food and Enterprise Development Program (FED) http://dai.com	To Support Market-led and value chain-driven, dedicated to building indigenous capacity, and focused on benefiting Liberia's women and youth.	Agriculture production, marketing and processing capacity development	DAI,USAID, women Food producers, Micro- Entrepreneurs Implementer: :DAI	Policy, institutions, farmer's organization, individuals capacity development	2011–2016	1,200,000	USA
5. Emergency Food Security and Rural Development Programme. http://operations.ifad.org	To support the strategies and plans of the Government of Niger to mitigate the impacts of a major food and pastoral crisis brought on in 2010 by drought in the most exposed regions of the country	Food-insecure and other highly vulnerable households. Strengthening of irrigated rice production systems. Rural development support infrastructure.	IFAD, OPEC Fund for International Development, World Bank Implementer: IFAD	Policy Development	2011 - 2014	35 7 00,000	IFAD
6.Food Security and Development Support Project in the Maradi Region http://operations.ifad.org	improve the living conditions and resilience of rural groups in the region through economic development based on the marketing of cereals, market-garden produce and livestock	Build the capacities of producers' organizations, such as cooperatives, unions and federations, as well as rural action groups, including village committees and women's groups.	IFAD,FAO Implementer: :IFAD	Individual capacity development	2012 - 2018	31 700 000	IFAD,FAO
7.Project for the Promotion of Local Initiative for Development in Aguié http://operations.ifad.org	To improve farmers revenue and livelihood by focusing to rural women and a youth of arguie department in rural community of SaéSaboua et Giratawa	Capacity building	UNDP. Implementer: Government of Niger through ministry of Agriculture	Individual capacity development	2005 - 2013	37600 000	Belgian Survival Fund for the Third World (BSF), IFAD, Italy

Appendix 17: Capacity Development Initiatives in Liberia

Initiative on CD	Goal	Thematic focus	Focus of CD	Partners	Timeframe	Funding (US$)	Funding source (G20 countries)

1.Supporting farmer's organization in post conflict countries- the case of Liberia. http://www.fao.org	Strengthening farmer based organizations through enhancing production, processing and marketing skills.	Capacity development activities included training of trainers in marketing, business skills and organizational skills. Farmer Field Schools	Community/farmer's organisations	FAO Implementer: The Government of Liberia	2012-2013	NA	Italian
2.Technical Assistance under the South-South Cooperation (SSC) with the Republic of China in support of the National Programme for Food Security (NPFS) in Liberia https://extranet.fao.org	To Contribute to the implementation of the National Programme for Food Security (NPFS) through its support to ongoing initiatives and projects in Liberia	Crop production, Capacity development	Institution capacity development	South-South Cooperation (SSC) Implementer :FAO	2012-2014	12 00,000,000	China
3.Consultant Services For Strengthening Food Crop Value Chains in Lofa and Bong Count https://extranet.fao.org	Strengthening Food Crop Value Chains in Lofa and Bong Counties through	Support for Farmer-Based Organizations (FBOs) in the production and marketing of food crops and tree crops	Policy, institutions, farmer's organizations, individual capacity development	FAO Implementer :The Government of Liberia	2012-2013	890,556	world Bank Group through IDA
4.Support to reduced post-harvest losses and improved income of fishers through a product-centred http://coin.fao.org	To Improve handling, processing, and marketing for increased income generation for beneficiaries.	Fishery	Institution, individual capacitydevelopment	Implementer :FAO Liberia	2012-2013	346,000	FAO Liberia
6. LDCF - Liberia - Enhancing Resilience to Climate Change by Mainstreaming Adaptation Concerns to Agricultural Sector Development. http://www.thegef.org	To strengthen individual and institutional capacity to better manage the effects of climate change in the agricultural sector and to reduce vulnerability, providing innovative, socially sustainable and appropriate adaptive measures piloted at the community level.	Climate change in the agricultural sector	individual and institutional capacity development	UNDP, Ministry of Agriculture, LDCF, Implementer: Ministry of Agriculture	N/A	2,381,500	World Bank GEF- LDCF
7. Extension and Advisory Services in Liberia. www.worldwide-extension.org	To provide basic services to a population including people economically active in agriculture	Extension services	individual capacity development	Public sector, Public extensions institutions, Public research and education institutions, NGOs Implementer: Ministry of Agriculture	N/A	N/A	USA, European Union
8. Liberian Agricultural Upgrading, Nutrition and Child Health (LAUNCH) http://www.acdivoca.org	Increasing Availability of and Access to Food	Agriculture production and processing capacity development	Institution capacitydevelopment	CDI/VOCA, Concern International. John Snow Inc. Making sense International. Implementer: Ministry of Agriculture	N/A	40,000,000	USA

9. Mainstreaming and Capacity Building for Sustainable Land Management in Liberia. http://www.lr.undp.org	To strengthen technical capacity of tertiary institutions to be responsive to adaptation strategies identified at demonstration sites; To enable these institutions produce agriculturists with the requisite contemporary knowledge of climate change adaptation in agriculture	Capacity Development for Climate Change Management in Agriculture Sector	Institution capacitydevelopment	University of Liberia, GEF, UNDP,UNCC Implementer: Government of Liberia	N/A	960,000	USA Through UNDP and GEF
10. USAID Liberian Food and Enterprise Development (FED) http://dai.com	To improve nutrition and food security by increasing agricultural productivity and market access and building human capacity	Integrated soil fertility management (ISFM)	Institution capacity development	IFDC, smallholder farmers, microfinance institutions, agro-dealers, trade associations Implementer :DAI	2011-2016	N/A	USA through USAID

Appendix 18: Capacity Development Initiatives in Benin

Initiative on Capacity Development	Goal	Thematic focus	Focus of Capacity Development	Partners	Timeframe	Funding (US$)	Funding source (G20 countries)
1. Strengthening the national ARD capacity in Benin_ ICRA. http://www.icra-edu.org	To coordinate ARD capacity building and promote its use though development of national innovation plat-forms	Agriculture innovation plat-forms	Institution capacity development	Faculty of Agronomic sciences (FASA), University of d' abomey Calavi (UAC), Ecole polytechnique d' abomey, IFDC, Bio diversity International Implementer: ICRA	2011-2013	N/A	Netherlands through ICRA
2. Support promotion and valorization of some non-woody forest products (PFNL) in order to contribute to food security in Benin	To improve forest management for forest products increase	Forest	Institution capacity development	Cotton farmers Implementer: The Government of Benin	2011-2013	416,000	EU
3.Intra-African Training and Dissemination of Technical Know-how for Sustainable Agriculture and Rural Development with Africa-ASEAN Country Cooperation within the Framework of South-south Cooperation. http://coin.fao.org	To synthesize and consolidate successful experiences of Japanese technical cooperation or technologies developed in advanced developing countries for increasing agricultural production and productivity in Africa and ASEAN countries and their sustainable spread and dissemination to farmers, foresters, fishermen, extension workers and government officials in the LDCs of Sub-Saharan Africa in cooperation with "South-South Cooperation	Increasing agricultural	Institution and policy capacity development	Philippines, Japanese, FAO Implementer: Government of Benin	2007-2013	6,273,361	Japan
4. Improving the Access of Non-Cotton Agricultural Producers in Benin http://www.ifdc.org/Projects	To help farmers to increase yields of maize, rice three crops by 40 percent	Support Maize, rice production	Individuals capacity development	IFDC, smallholder farmers and agro-dealer organizations, agro-input suppliers, financial institutions Implementer: IFDC	2009-2013	N/A	Netherlands

5.Adapted Rural Financing Services Promotion Project http://operations.ifad.org	Developing new, innovative rural financial products and services and improving existing products, all based on industry best practices.	Enhance financial autonomy and increase the level of credit available for the production, processing, storage and marketing of agricultural products.	Policy capacity development	Benin, IFAD Implementer: IFAD	N/A	35 200 000	IFAD
6. Rural Economic Growth Support Project. http://operations.ifad.org	To support sustainable rural economic growth and poverty reduction.	The establishment and strengthening of inter-professional unions to that can defend members' interests The construction of rural infrastructure to improve marketing of agricultural products	Institution capacity development	FAO,UNDP Implementer: IFAD	2010 - 2016	47 8 00 000	IFAD

Appendix 19: Regional Capacity Development Initiatives in CORAF-WECARD

Initiative on Capacity Development	Goal	Thematic focus	Coordinating Country	Focus of the Capacity Development Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
1.Options for the sustainable intensification of agro-sylvipastoral production systems) (Burkina Faso, Mali, Senegal, Niger)	Improve in a sustainable manner the productivity of agro-sylvipastoral systems in the sub-humid and semi-arid zones of West Africa	Agroforestry system (agro-sylvipastoral production)	Burkina Faso.	Institution development	Burkina Faso, Mali, Senegal, Niger	2011-2014	2,500,000	Australia
2. Policy, programmes strategies for natural resource management with emphasis on Non Wood Forest Products (NWFP): What works for small farmers in Burkina Faso, Cameroon and Senegal (PPMC)	To promote the development of policies, programmes and strategies for the management and basic use of NWFP natural resources that are efficient, effective and fair in order to strengthen the contribution of NWFPs to the subsistence of small farmers, particularly women and other vulnerable groups	Policy development	INERA	Policy development	Burkina Faso, Senegal, Cameroun	011 - 2014	2,290,000	MDTF (Australia, Belgium, Canada, Denmark, the EU, Finland, France, Germany, Japan, the Netherlands, Norway, Spain, Switzerland, the UK, and the USA)
3.Strengthening of seed systems Research and Development Africa (Burkina Faso, Ghana, Mali, Cameroon)	Establish effective and sustainable seed systems for the main staple crops (sorghum, millet, maize, and groundnuts) in Burkina Faso, Cameroon, Ghana and Mali.	Seed improvement	Mali	Institution development	Burkina Faso, Ghana, Mali, Cameroon	2011-2014	1,300,000	Australia
4.Optimization of compromise between productivity and diversity of perennial species in the cocoa production systems of West and Central Africa (PGRN) (Cameroon, Benin, Cote d'Ivoire, Liberia)	Improve the sustainability of small-scale extensive aquaculture in West and Central Africa based on an analysis of the innovative aquaculture process	Aquaculture	Cameroon	Institution development	Cameroun, Côte d'Ivoire, Ghana	2011 – 2014	498,452	MDTF (Australia, Belgium, Canada, Denmark, the EU, Finland, France, Germany, Japan, the Netherlands, Norway, Spain, Switzerland, the

Initiative on Capacity Development	Goal	Thematic focus	Coordinating Country	Focus of the Capacity Development Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
								UK, and the USA)
5.Strengthening Capacity for Agricultural Research and Development in Africa (SCARDA) in Togo, Benin, RDC, Brazzaville, Congo Cameroon	The integrated management technologies promoted in the production systems of plantain in AOC	Plantain	CORAF	Institution development	Mali, Congo Brazzaville, Gambia, Ghana	2010-2013	800,000	USA
6. Improving maize productivity and its dissemination through the promotion of integrated management technologies in the Savannah zone of Cameroon, Nigeria and Chad. ITRAD, Chad	Technologies/innovations for improving maize productivity are promoted	Maize crop	Chad	Institution development	Cameroon IRAD, University of Nigeria Maïduguri, Chad	2010-2013	350,000	USA
7. Promotion of post-harvest technologies in the storage and processing of maize and cowpea to reduce losses and to improve market quality in WCA.(Cameroon Sénégal, Guinée, Niger)	The post-harvest technologies of storage and processing of maize and cowpea are generated and disseminated	Post-harvest technologies	Senegal	Institution development	Niger (INRAN) Guinée (IRAG) Sénégal (ITA et ISRA) and Cameron	2010-2013	450,000	USA
8. A tree-cereal-livestock integrated system for a sustainable use of land and improved living conditions for small farmers of the Sahel (CerLiveTreeS)(Burkina Faso, Mali, Senegal, Niger)	Improve the cereal-livestock-tree integrated systems and the livelihoods of small farmers thanks to a sustainable management of the territory in the Sahel, within the context of the degradation of farmlands and climate change	Agroforestry promotion	Niger	Institution development	Niger, Burkina, Faso Cameroon, Senegal and Faso, Mali,	2011-2014	2,100,000	Australia
9.Sustainable intensification of agriculture-livestock integrated systems to increase the productivity of agropastoral systems and food security in West and Central Africa (ISIAE) (Burkina Faso, Senegal, Cameroon, Chad)	Promote the development of policies, programmes and strategies for the management and basic use of NWFP natural resources that are efficient, effective and fair in order to strengthen the contribution of NWFPs to the subsistence of small farmers, particularly women and other vulnerable groups	Agriculture-livestock intensification	Ghana	Policy and Institution development	Ghana, Mali , Togo	2011 - 2014	290,000	MDTF (Australia, Belgium, Canada, Denmark, the EU, Finland, France, Germany, Japan, the Netherlands, Norway, Spain, Switzerland, the UK, and the USA)

Initiative on Capacity Development	Goal	Thematic focus	Coordinating Country	Focus of the Capacity Development Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
10.West African Cotton Improvement Program	To helping local textile artisans to develop new products and extend their reach to both domestic and international markets	Cotton Improvement		individual capacity development	Extension services, NGOs, agricultural research, US-based partners: Abt Associates, Aid-to-Artisans, Auburn , University, Michigan State University	N/A	N/A	USA
11.Strengthening of seed systems in West and Central Africa Burkina Faso, Ghana, Mali, Cameroon	Establish effective and sustainable seed systems for the main staple crops (sorghum, millet, maize, and groundnuts) in Burkina Faso, Cameroon, Ghana and Mali	Seed improvement	Mali	Institution capacity development	Ghana, Mali, Cameroon, Burkina Faso	2011-2014	1,300,000	Australia
12. An integrated cereal-livestock-tree for the sustainable use of land and improved living conditions of small farmers in the Sahel (CerLiveTreeS)	To improve the cereal-livestock-tree integrated systems and the livelihoods of small farmers thanks to a sustainable management of the territory in the Sahel, within the context of the degradation of farmlands and climate change (Burkina Faso, Mali, Niger, Senegal)	Agroforestry	Niger	individual capacity development	Burkina Faso, Mali Niger, Senegal.	2011-2014	2 100 000	Australian
13.Improving the Access of Non-Cotton Agricultural Producers in Benin (Benin Non-Cotton)	To increase farmer capacities to produce maize, pineapple and rice through access to quality agro-inputs, training and enhanced market linkages	Agriculture market access and agro-inputs use capacity development	IFDC	Individual capacity development	Benin, Burkina Faso, Ghana and Togo	2011-2014	2,100,000	Netherlands
14. Reducing Dependence on POPs and other Agro-Chemicals in the Senegal and Niger River Basins through Integrated Production, Pest and Pollution Management	To protect trans-boundary waters in the Niger and Senegal River Basins through elimination of POPs pesticide-use and substantial reduction and elimination of other toxic pesticides used in agriculture	Best practices for contaminant	Senegal and Niger	Institution development	UNDP,UNEP	2009 2013	4,105,329	USA through GEF
15.Facilitating innovation platforms to trigger institutional change in West Africa	To Facilitating institutional change	strengthening innovation systems"	Benin	Institution development	Benin, Ghana, Mali Universities Netherlands: Wageningen University & Research Centre, the Royal Tropical Institute (KIT)	2008–2013	€4.500,000	Netherlands

Appendix 20: Regional Capacity Development Initiatives in CORAF-WECARD-ECOWAS

Initiative on Capacity Development	Goal	Thematic focus	Partners	Timeframe	Funding ($US)	Funding source(G20 countries)
1. Strengthening Regional Agricultural Integration in West Africa (SRAI Programme) 15 ECOWAS countries.	To provide specific, targeted empirical information to policy stakeholders in West Africa to inform the debate about how West African agriculture and agribusinesses can respond to the region's rapidly growing and changing demand in a way that ensures broad-based benefits to farmers.	Food demand in West Africa -Rice market and its implications for West Africa;	15 Countries of ECOWAS	2013-2015	1,653,204	USA (Michigan state University, Agriculture, Food , and Resources, Economics)
2.West Africa Bio-safety project	To protect regional biodiversity against the potential risks associated with the introduction of living modified organisms (LMOs) into the environment.	Agriculture & Fisheries	West Africa Region, World Bank	2007-2013	3,900,000	Word Bank
3.Mainstreaming Pro-Poor Fertilizer Access and Innovative Practices in West Africa	Improved land husbandry and better access to, and more efficient use of fertilizer	ISFM, natural resources, improved technologies, competitive markets, private enterprise development and national policy advocacy. Technologies	IFAD,IFDC	2010-2013	NA	USA, Through IFAD and IFDC
4. Niger Basin Water Resources Development & Sustainable Ecosystems Management	To enhance regional coordination, development and sustainability of water resources management in the Niger River Basin	Watershed management, irrigation	World Bank, West Africa Region	2007-2014	186,000,000	World Bank.
5.Building capacity for Competitive Agricultural Systems and Enterprises in West Africa - IFDC CASE	To collaborate in strengthening the capacity of national partners of IFDC-A in Benin, Burkina Faso, Ghana and Mali to collectively mainstream and scale out the use of the Competitive Agricultural Systems and Enterprises (CASE) approach	Agriculture innovation plat-forms and up-scaling of agricultural systems	Benin, Burkina Faso, Ghana ,Mali, IFDC-Africa	N/A	N/A	Netherlands through ICRA
6. USAID West Africa Cotton Improvement Program (WACIP)	To boost the productivity and profitability of the cotton sector in Benin	Research input distribution, private enterprises, inter-professional associations and textile artisans	AUSAID /WACIP	2007-2013	17,000,000	USA, the Mali, Benin, Burkina Faso, Abt Associates, Aid to Artisans and Auburn, Michigan State and Tuskegee universities
7.Initiatives for sustainable integrated development(IDID)	To strengthen the climate change adaptive capacities of the communities	Climate change resilience and adaptation capacity development	GEFU,UNDP,UNEP		N/A	N/A
8. The Sustainable Tree Crops Program (STCP)	To generate growth in rural income among tree crop farmers in an environmentally and socially responsible manner in West/Central Africa	Technology transfer, marketing, and institutional innovations,	Farmers, the global cocoa industry, local private sector, national governments, NGOs, research institutes, and development investors	N/A	N/A	USA , EU

Initiative on Capacity Development	Goal	Thematic focus	Partners	Timeframe	Funding ($US)	Funding source(G20 countries)
9. Strengthening Capacity for Yam Research-for-development in Central and Western Africa (SCYReC)	To contribute to improvement in the capacity for yam research-for-development in CWA that will help in finding sustainable solutions, through science and technology, to the challenges facing the crop and exploit its tremendous potential for food security and poverty alleviation	Research Capacity development	CSRS,CRI,NRCRI,UI, Univ-Abj),ITRA, INRAB, IRAD,PNDRT, CNRA, CIRES	N/A	N/A	IITA
10. INSTAPA(Benin, Burkina Faso, Kenya, Mali)	To contribute to improvement of the dietary quality of young children and their mothers living in resource poor areas of developing countries resulting in long-term health effects and a major step towards the Millennium Development Goals set for 2015	Improvement of millet-, sorghum-, maize-, and cassava-based foods,	Kenya Agricultural Research Institute	2008-2013	N/A	EU (Belgium), WAGENINGEN (Netherlands)
11. Development and commercialization of biological control of Aflatoxins	To improve income and health of farm families and generate wealth in the crop value chain by developing and making available commercially ready cost-effective biological control technology for Aflatoxin, in combination with other practices that will improve public health, increase agricultural trade, augment smallholder income, and enhance food security.	Technology and Innovation on pest and Disease management,	USDA, AATF,KARI	N/A	1,320,000	Bill & Melinda Gates Foundation
12. Management of Millet Head Borer to Increase Pearl Millet Production in the Sahel - Phase II	To increase production of pearl millet and incomes of populations by reducing losses caused by the MEM in the three targeted countries (Burkina Faso, Mali, Niger)	Pest and disease management ,	N/A	2009-2013	N/A	USA through MCKNIGHT FOUNDATION
13. MycoRed	To develop novel solution driven methodologies and handling procedures to reduce both pre- and post-harvest contamination in the selected feed and food chains, and to generate and disseminate information and education strategies to reduce mycotoxin risks at a global level	Pre- and post-harvest management contamination management	N/A	2009-2013	N/A	EU, Italie
14. Yam improvement for income and food security in West Africa	-Strengthen small-scale farmer and trader market linkages, particularly in less accessible production areas, to realize benefits from increased ware yam productivity and market demand; -Strengthen capacities and empower smallholder farmers in the yam value chain.	Yam value chain	IITA,NRI,FOSCA,NRCRI,MSHR, SARI	N/A	12,2 00,000	Bill & Melinda Gates Foundation
15. Agricultural Input Market Strengthening	To improve farmers' access to agro-inputs through more competitive markets and improved agro-dealer networks	Integrated Soil Fertility Management (ISFM)	IFDC, PARTI, agro-dealers , FAO, the EU, extension agents	2006-2014	N/A	U.S A through . U SAID
16. Fertilizer and Sustainable Agricultural Development	To develop and promote more intensive and sustainable agricultural technologies at the local level, while building agribusiness models at the regional level	Integrated Soil Fertility Management	IFDC, farmers and local entrepreneurs, agro-input dealers		N/A	U.S. A through SAID and IFA
17. Marketing Inputs Regionally Plus	Supporting Innovative Approaches that Increase Agro-Input Use and Efficiency	Agro-input market	IFDC, AGRA, agro-input dealers,	2009 - 2013	400,000,000	The Netherlands through DGIS funds

Initiative on Capacity Development	Goal	Thematic focus	Partners	Timeframe	Funding ($US)	Funding source(G20 countries)
18. Prevention of Seed Cotton Contamination in West Africa	Eliminating contamination primarily through training, public awareness campaigns and incentive programs at regional, national, sub-national, community and farm levels	Prevention of Seed Cotton	IFDC ,ICAC, Cotton Farmer producer	2009-2013	N/A	EU and the United Nations through CFC
19. USAID West Africa Fertilizer Program	To increase the regional availability and use of appropriate and affordable fertilizers	Regional supply and distribution of fertilizers. Fertilizers use	IFDC,AFAP, agro-dealers, importers, blenders and wholesalers	2012-2017	N/A	U.S.A through U SAID
20. Building Capacity of ECOWAS for effective CAADP Implementation in West Africa	To Build a sustainable structure to support export competitiveness by promoting high export potential value chains and increasing exports through engaging the region's private sector, donors, partners and other valuable stakeholders.	ECOWAS Regional Agricultural Investment Programme (RAIP)	NEPAD,FAO , World Bank	2012-2015	4,016,064	USA

Appendix 21: Continental Capacity Development Initiatives in Africa

Initiative on Capacity Development	Goal	Thematic focus	Focus of the CD Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
1. Intra-African Training and Dissemination of Technical Know-how for Sustainable Agriculture and Rural Development with Africa-ASEAN Country Cooperation within the Framework of South-south Cooperation	To synthesize and consolidate successful experiences of Japanese technical cooperation or technologies developed in advanced developing countries for increasing agricultural production and productivity in Africa and ASEAN countries and their sustainable spread and dissemination to farmers, foresters, fishermen, extension workers and government officials in the Least Developed Countries (LDCs) of Sub-Saharan Africa in cooperation with "South-South "	Increasing agricultural production	Institution capacity development	Philippines, Japanese	2007-2013	6,273,361	USA
2. Africa Soil Health Consortium	To improve access to effective and appropriate materials regarding ISFM in the public and private sectors	Soil fertility improvement	Institution capacity development	IFDC, Policymakers , university , extension workers, input suppliers and farmers	2011 - 2014	N/A	U.S. U through SAID Bill & Melinda Gates Foundation
3. Integrated *Striga* Management in Africa (ISMA)	Increase the productivity of maize and cowpea by 50-100% by 2014 in 2% of the Striga-infested areas	Maize and cowpea production	Institution capacity development	AATF , CIAT, Rothamsted research, Institute for agriculture research SAMARU, Farmer	N/A	N/A	Bill & Melinda Gates Foundation
4.African Technology Policy studies Network, *Build*	To contributing to the achievement of the UN Millennium Development Goal	Innovation in African agriculture through targeted training and	Policy capacity development	UNEP, UNESCO, FARA, Harvard University, USA, AAU, ICRISAT,ITDG-EA,ICIPE , Kenya, UNU/INTECH	N/A	50,000,000(For 30 target Countries including ,	Germany ,UK European Commission UNESCO,UNEP,ADB,IDRC,

Initiative on Capacity Development	Goal	Thematic focus	Focus of the CD Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
Africa's Science, Technology and innovation (STI)	number One (MDG 1) which calls for the eradication of extreme poverty and hunger and halving hunger and poverty by 2015 in relation to 1990	field demonstrations in selected countries				Burkina Faso, Benin, Liberia, The Gambia)	Coca-Cola, COMESA
5.Effective Grain Storage	To enhance the delivery of the metal silo technology and hermetic post harvest bags to a wider community	Training, research, extension, post-harvest storage	individuals capacity development	Kenya, Zambia Agricultural Research Institutes, Bunda College of Agriculture, Malawi and Zimbabwe, University of, Catholic Diocese of Homa Bay and Embu, World Vision International – Malawi, MashAgrikLtd, Women in Agribusiness in Sub-Sahara Africa Alliance (WASAA), Artisans, farmers, and trainer	2012-2016	N/A	Swiss through Agency for Development and Cooperation (SDC)
6.Improved Maize for African Soils Project (IMAS)	Development of transgenic maize varieties adapted to southern and eastern Africa with increased yield under severe nitrogen limitation	Improved Maize variety	Institution capacity development	the DuPont Business, Pioneer Hi-Bred; the Kenya Agricultural Research Institute (KARI); and the South African Agricultural Research Council (ARC)	2010-on going	19,500,000	Bill & Melinda Gates Foundation, USAID
7. The Water Efficient Maize for Africa (WEMA) Phase II	To help farmers manage the risk of drought by developing and deploying maize varieties that yield 24 to 35 percent more grain under moderate drought condition	Breeding, climate change (Biotechnology, Develop drought tolerant and insect-pest resistant maize varieties through conventional, molecular, and genetic engineering breeding approaches)	Individual capacity development	The African Agricultural Technology Foundation (AATF; leading the partnership). CIMMYT, Monsanto, KARI, Mozambique National Institute of Agronomic Research (IIAM), The Agricultural Research Council (ARC) of South Africa, The Tanzania Commission for Science and Technology (COSTECH), National Agricultural Research Organization of Uganda, Seed companies and organizations such as the African Seed Traders Association and seed associations in project countries are crucial to success.	2013-2017		Bill & Melinda Gates Foundation, Howard G. Buffett Foundation
8. Strengthening Capacity for Safe Biotechnology Management in sub-Saharan Africa (SABIMA)	Changing mindsets and concepts on biotechnology; advocating and influencing the processes towards biotechnology and biosafety policies	Biotechnology and biosafety	A train-the-trainer component in biotechnology stewardship Information gathering and dissemination on the status of biotechnology in the project countries and elsewhere in Africa	FARA and the national agricultural research systems (NARS) of Burkina Faso, Ghana, Kenya, Malawi, Nigeria and Uganda.	2009 - 2013		Syngenta Foundation for Sustainable Agriculture (SFSA)

Initiative on Capacity Development	Goal	Thematic focus	Focus of the CD Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
			Awareness creation and advocacy for issues of biotechnology and its stewardship				
9. SCARDA	Improving the capacity and performance of participating NARS in key areas of their agricultural research for development (AR4D) functions	Human and institutional capacity strengthening	Strengthening agricultural research management systems and managerial competencies MSc training and mentorship (individual and organizational) Tracer studies on agricultural graduates	FARA, ASARECA, CORAF/WECARD, SADC/FANR, ANAFE, RUFORUM, AGHRYMET, NRI (UK) and 12 NARIs and universities in Gambia, Mali, Ghana, Congo, Botswana, Zambia, Lesotho, Rwanda, Burundi, and Sudan	2007 - 2010	14 million	DfID, UK
UniBRAIN	Promoting innovation by improving the flow of technology and knowledge by removing barriers between actors in the value chains	Strengthening agribusiness capacity through incubation and curricula reforms	Commercialisation of agribusiness innovations supported and promoted. Agribusiness graduates with the potential to become efficient entrepreneurs produced by tertiary educational institutions UniBRAIN's innovative outputs, experiences and practices shared and up-scaled	FARA, ANAFE, PanAAC, various universities, NARIs and agribusinesses in Kenya, Uganda, Zambia, Ghana, and Mali, ICRISAT-Agribusiness and Innovation Platform, ASARECA, CORAF/WECARD, CCARDESA	2010 - 2014	18 million	Danida
The Sub Saharan Africa Challenge Program (SSA CP)	Encouraging innovation and a systems perspective to ARD	Integrated Agricultural Research for Development (IAR4D), agricultural innovation platforms along value chains	Delivering international public goods concerned with best practices in relation to multi-stakeholder engagement in the generation and wide-scale adoption of agricultural innovations Evaluating whether IAR4D works and is more cost/benefit effective relative to conventional approaches.	FARA, IITA, IFDC, INRAN, RAB (Rwanda), Makerere, ICRISAT, CIAT, IPGRI, SOFECSA, CIMMYT, TSBF	2008 - 2014	20 million	EU/IFAD
Dissemination of New Agricultural	To catalyze increased adoption of high-impact agricultural	Technology dissemination through	To analyse the agricultural value chains in African	FARA, ASARECA, CORAF/WECARD, CCARDESA, NPCA	2007 - 2013		AfDB

Initiative on Capacity Development	Goal	Thematic focus	Focus of the CD Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
Technologies in Africa (DONATA)	technologies by stakeholders through effective learning and acquisition of skills needed to efficiently practice innovations	innovation platforms for technology adoption (IPTA)	countries and use proven technologies to address constraints with a view to scaling out and scaling up the adoption of these technologies for accelerated agricultural development To identify promising dissemination pathways that will facilitate the targeting of technologies to fit the prevailing social, environmental and market conditions, and to enable potential adopters to make profitable investments To promote wide adoption of promising African technologies such as new crop varieties, natural resource management, along the agriculture value chain				
RAILS	To fill current gaps in the rural community–NARS–regional–continental–global information chain	Dissemination of information	To undertake advocacy to encourage increased investment in agricultural information systems (AIS) by African governments and institutions; To improve access to information and the ability of African stakeholders to contribute to global agricultural knowledge; To facilitate synergies by linking African information conduits to global providers of agricultural	FARA, ASARECA, CORAF/WECARD, CCARDESA, NPCA, NARS, GFAR, WISARD, CABI, EARD, InfoSys+	2007 - 2013		African Development Bank (AfDB)

Initiative on Capacity Development	Goal	Thematic focus	Focus of the CD Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
			information; and To develop an African platform for agricultural information and learning systems				
AfricaAdapt	To facilitate the flow of climate change adaptation knowledge for sustainable livelihoods between researchers, policy makers, civil society organisations and communities who are vulnerable to climate variability and change across the continent	Climate change adaptation	An innovation fund offering small grants for new approaches to knowledge sharing Radio-based programming and dialogues in local languages, developed with community radio broadcasters across the continent Face-to-face meetings bringing people together to exchange ideas and overcome challenges A CD-Rom and paper-based dissemination service for network news and resource	Environment and Development in the Third World (ENDA-TM), Forum for Agricultural Research in Africa (FARA) and IGAD Climate Prediction and Applications Centre (ICPAC)			IDRC, DfID
Strengthening Africa's Strategic Agricultural Capacity for Impact on Development (SASACID)	To build relevant human capacity and transmitting technical skills within the field of agriculture and natural resources in SSA	Capacity strengthening, tertiary agricultural education	Raise the quality and relevance of agricultural education at the tertiary level to encompass the cross-cutting issues that are pertinent to attaining sustainable and profitable agriculture Developing new cadres of professionals capable of assuming key roles in national, regional and international agricultural science, extension, business and policy	Makerere University, TSBF-CIAT, African Forest Research Network (AFORNET), African Academy of Sciences (AAS), African Institute for Capacity Development (AICAD), African Regional Postgraduate Programme in Insect Sciences (ARPPIS), International Institute of Insect Physiology and Ecology (ICIPE), Conference on Central African Moist Forest Ecosystems (CEFDHAC), IUCN, Collaborative Masters in Agricultural and Applied Economics (CMAAE), Agricultural Economics Education Network (AAEEN), East African Plant Genetic Resources Training Consortium (EAPGRTC), IPGRI, East African Regional Programme and Research Network for Biotechnology, Biosafety and Biotechnology Policy	5 years	33 million	SIDA, AfDB

Initiative on Capacity Development	Goal	Thematic focus	Focus of the CD Initiative	Partners	Timeframe	Funding($US)	Funding source (G20 countries)
				Development BIO-EARN, Global Open Food and Agriculture University (GO-FAU), IFPRI, Network of Forest and Environmental Training Institutions , Regional Universities Forum for Capacity Building in Agriculture (RU-FORUM), Sub-Saharan African Forest Genetic Resources Network (SAFORGEN), African Network for Science and Technology Institutions (ANSTI), UNESCO, FARA, ASARECA, CORAF and SADC-FANR			

Appendix 22: Stakeholder Survey Questionnaire

Assessment of National Agricultural Systems of Innovation (NAIS) in ……..

A joint research project by Food and Agriculture Organization of the United Nations (FAO)

and

…….

Contacts:
First Name Last Name
Institution
Address
Country
Tel: Fax:
E-mail:

INTRODUCTION

Dear Madam/Sir
In developing countries, most of the challenges facing agriculture and natural resources management can be addressed through innovation. But many developing countries don't have sufficient resources or capacities to develop effective national agricultural innovation systems (NAIS)[48]. The "capacity gap" is worse in the tropics, where poverty is pervasive.
In an effort to address this problem, the G20 Agriculture Ministers requested that FAO lead the development of a Tropical Agricultural Platform (TAP).
TAP was launched at the first G20-led Meeting of Agriculture Chief Scientists (MACS) in September 2012 in Mexico (with the endorsement of the G8 leadership).
The "target groups" directly affected by the Platform activities are policymakers and institutions in agricultural innovation (research, extension, education etc), together with the private sector and civil society active in innovation systems, and relevant development agencies.
The partners of the Platform are a coalition of willing and committed partners/constituents in the G20 and developing countries, and the key regional and international fora, networks and agencies.
This questionnaire constitutes part of a needs assessment survey currently conducted in Central America, Africa and Southeast Asia.
In this context, you have been identified as a key stakeholder in the agricultural innovation system and we would therefore appreciate it very much if you could participate in this survey and contribute to the success of this global initiative.
Thank you.
.....
.....
Karin Nichterlein
Agricultural Research Officer, FAO

Stephen Rudgard
Head of the Knowledge and Capacity for Development Unit, FAO

[48]The agricultural innovation system (AIS) approach is defined as a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic, social and/or environmental use, together with the institutions and policies that affect their behavior and performance.

Part 1: Challenges of the current NAIS

The following question will give us a broad idea of your assessment of the different challenges in the National Agricultural Innovation System (NAIS) in your country.

In your opinion, how important is each of the following challenges in the NAIS in your country?

	not important at all			very important	don't know
Public Policy					
1. Lack of clear national innovation strategy	1	2	3	4	□
2. Insufficient coordination within government	1	2	3	4	□
3. Lack of policy dialogue with other actors (civil society, farmer organizations, academia, business)	1	2	3	4	□
4. Lack of incentives to innovate	1	2	3	4	□
5. Regulation that makes innovation costly	1	2	3	4	□
6. Neglect of extension services and advisory services	1	2	3	4	□
7. Lack of appropriate legal framework to support innovation In the public sector	1	2	3	4	□
8. Low quality of entrepreneurial infrastructure (IT, business services, bureaucracy etc)	1	2	3	4	□
9. Exclusion of local stakeholders e.g. farmers and consumers in design of innovations	1	2	3	4	□
Private Sector					
10. Lack of private sector investment in agriculture	1	2	3	4	□
11. Distrust of public-private partnership in R&D	1	2	3	4	□
12. Lack of willingness to share knowledge with others	1	2	3	4	□
13. Domestic private sector decoupled from NAIS	1	2	3	4	□
14. Lack of responsiveness to needs of small producers	1	2	3	4	□
15. Difficulties to access to proprietary (IP) technology (e.g. new plant varieties/animal vaccines, etc)	1	2	3	4	□
16. Difficulties to access to technology without IP protection[49] (e.g. breeding tools/plant protection where IPR expired)	1	2	3	4	□
Farming Sector					
17. Low innovation adoption rates among farmers due to					
lack of access to technology	1	2	3	4	□
lack of financial services (credit, insurance),	1	2	3	4	□
knowledge/awareness (capacity),	1	2	3	4	□
lack of market access (infrastructure)	1	2	3	4	□

[49] Intellectual property (IP) refers to creations of the mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce.

lack of effective extension services 1--------2--------3-------4 □

18. Lack of recognition for grassroots/ farmers innovation 1--------2--------3-------4 □

19. Lack of responsiveness to farmer needs

at universities 1--------2--------3-------4 □

in public research institutes 1--------2--------3-------4 □

in public extension services 1--------2--------3-------4 □

in the private sector 1--------2--------3-------4 □

in civil society 1--------2--------3-------4 □

20. Low rates of technology/knowledge exchange between

Universities and practitioners 1--------2--------3-------4 □

Public research institutes and practitioners 1--------2--------3-------4 □

in public extension services and practitioners 1--------2--------3-------4 □

in the private sector and practitioners 1--------2--------3-------4 □

in civil society and practitioners 1--------2--------3-------4 □

research and extension 1--------2--------3-------4 □

Society/Education

21. Lack of embeddedness of innovation in the local context 1--------2--------3-------4 □

22. Skepticism towards innovation-driven entrepreneurs 1--------2--------3-------4 □

23. Lack of awareness of the role of innovation in agricultural development 1--------2--------3-------4 □

24. Lack of infrastructure necessary to integrate rural regions into a system of agricultural innovation 1--------2--------3-------4 □

25. Limited number of academic courses/ degrees promoting innovation in agriculture 1--------2--------3-------4 □

Civil Society/NGOs/CSOs[50]

26. NGOs failing as effective knowledge brokers 1--------2--------3-------4 □

27. Different priorities of local and global NGOs 1--------2--------3-------4 □

28. Insufficient support for innovative farmers 1--------2--------3-------4 □

29. Lack of willingness to work with a wide range of Stakeholders including the private sector 1--------2--------3-------4 □

30. Absence of leaders/champions in agricultural innovation among CSOs/NGOs 1--------2--------3-------4 □

others: _____ 1--------2--------3-------4

_____ 1--------2--------3-------4

_____ 1--------2--------3-------4

_____

[50] NGOs (Nongovernmental Organisations), CSOs (Civil Society Organisations)

Part 2: Innovation challenges and actors involved

1. In which of the following areas, do you think innovation would be highly needed?

Environmental challenges

1.	Water management	1--------2--------3-------4	□
2.	Soil management	1--------2--------3-------4	□
3.	Climate change mitigation	1--------2--------3-------4	□
4.	Climate change adaptation	1--------2--------3-------4	□

Agricultural challenges

1.	crop production	1--------2--------3-------4	□
2.	crop-livestock systems	1--------2--------3-------4	□
3.	livestock management	1--------2--------3-------4	□
4.	fisheries/aquaculture	1--------2--------3-------4	□
5.	added-value products (quality labels)	1--------2--------3-------4	□

Economic and social challenges

1.	Poverty reduction through entrepreneurship	1--------2--------3-------4	□
2.	Off-farm employment	1--------2--------3-------4	□
3.	Policy instruments to facilitate innovation	1--------2--------3-------4	□
4.	Food chain management	1--------2--------3-------4	□
5.	Improving the livelihood of small producers	1--------2--------3-------4	□
6.	Improving the participation of women in the Rural economy	1--------2--------3-------4	□

others: _____ 1--------2--------3-------4

_____ 1--------2--------3-------4

2. Which stakeholders play the most important roles to bring about innovation in your country? (please select three and rank them according to their importance)

□ Private advisory, extension and information services (brokers, business development services, input providers)

□ Public advisory, extension and information services (secretary of agriculture on national/state level)

□ Multinational companies

□ Domestic private sector

□ NGOs

□ Farmer organizations

□ Universities

□ National research institutes

□ International research institutes (CGIARs, FAO, UNEP, UNCTAD, etc)

□ Donors

□ Others:_____

3. What type of innovation could best help to address the challenges (please mark with a cross (please make a cross if relevant)

		Environmental	Economic	Social
Technological innovation				
1.	platform technologies[51] with low-cost user-friendly products for producers	□	□	□
	> ICT (mobile phones, GIS/Google Earth)	□	□	□
	>biotechnology (micropropagation)	□	□	□
	>solar technology	□	□	□
2.	Grassroots innovations / Farmer innovation (e.g. rainharvesting)	□	□	□
2.	Agro-ecological techniques and practices (e.g. conservation agriculture, agroforestry integrated pest management)	□	□	□
Institutional/management innovation				
1.	reform of public extension services	□	□	□
2.	reform in of the education system	□	□	□
3.	market reforms	□	□	□
4.	government policies that enable the provision of			
	- extension services	□	□	□
	- technology	□	□	□
	- microfinance	□	□	□
	- business mentoring	□	□	□

others: _____

4. How important do you consider the following tools to encourage public-private partnerships for innovation?

1.	Government incentives (e.g. Matching Grants, Advanced purchasing agreements, tax credits)	1--------2--------3-------4	□
2.	Patent pooling initiative	1--------2--------3-------4	□
3.	E-licensing platforms	1--------2--------3-------4	□
4.	National marketing boards	1--------2--------3-------4	□
5.	Joint cooperation platforms	1--------2--------3-------4	□
6.	Others	1--------2--------3-------4	□

[51]A platform technology can be defined as a broad set of new instruments and techniques from which various products can emerge (e.g. biotechnology and information technology are platform technologies)

5. **Are the needs and priorities of women sufficiently included in the agenda of National Agricultural Innovation Systems?**

Not at all completely don't know

1--------2--------3-------4 □

If inadequate, what needs to be done (5-10 words)

---

6. **Are the needs and priorities of youth sufficiently included in the agenda of National Agricultural Innovation Systems? – and youth?**

Not at all completely don't know

1--------2--------3-------4 □

If inadequate, what needs to be done (5-10 words)

---

7. **Are the needs and priorities of small-scale producers sufficiently included in the agenda of the NAIS?**

Not at all completely don't know

1--------2--------3-------4 □

If inadequate, what needs to be done (5-10 words)

Part 3: How do you experience NAIS in your field

1. **What is your particular field of activity? (5-10 words)**

---

2. **What type of innovation has made great advances in your field over the past 5 years?**

(5-10 words)

---

3. **What do you perceive as the major challenge and the major opportunity related to this particular type of innovation?**

Challenge:

Opportunity:

---

4. Did this innovation benefit from a coherent National Agricultural Innovation System (NAIS)?

Not adequate at all	completely adequate	don't know
1--------2--------3-------4		□

If inadequate, what needs to be done (5-10 words)

---

5. What were the important benefits of the particular innovation with regard to farmers/pastoralists?

	Not important at all	very important	don't know
Increase in Income	1--------2--------3-------4		□
Increase in Productivity	1--------2--------3-------4		□
Improved management of risk	1--------2--------3-------4		□
Improved environmental management	1--------2--------3-------4		□
Improved health	1--------2--------3-------4		□
Higher quality of life	1--------2--------3-------4		□
Better access to institutions (markets, education, technology, gov decisions)	1--------2--------3-------4		□

Part 4: General Questions

Name of the organisation: _____

1. What is the size of your organisation?

Number of members: _____ *Number of full-time staff:* _____

2. When was your organisation founded? _____

3. What is the geographical scope of your activities ?

- □ *Local*
- □ *National*
- □ *Regional*
- □ *Global*

4. Which of the following terms would best describe your organisation?

- □ *Profit-seeking firm*
- □ *Non-profit organisation*
- □ *Government Organisation*
- □ *Others*

5. Who filled in the questionnaire?

Respondent's Name: _____
Respondent's Title: _____
Respondent's Telephone: _____
Second respondent (if any): _____
Respondent's Title: _____
Respondent's Telephone: _____